CONSTRUCTION QUALITY ASSURANCE PLAN
PHASE 1: Sediment and Upland Cleanup

Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

October 5, 2012
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PREPARED BY:

CRETE CONSULTING, INC.
Table of Contents

1 Introduction ............................................................................................................................ 1-1
  1.1 Activities Addressed by this Plan .................................................................................... 1-1
  1.1.1 Schedule ...................................................................................................................... 1-2
  1.2 Document Organization ................................................................................................. 1-3

2 Project Organization and Responsibilities ........................................................................ 2-1
  2.1 Teams ............................................................................................................................... 2-1
  2.2 Personnel Responsibilities ............................................................................................. 2-1
    2.2.1 Environmental Protection Agency .......................................................................... 2-1
    2.2.2 Port of Seattle ........................................................................................................... 2-2
    2.2.3 Contractor ................................................................................................................. 2-3
      2.2.3.1 Contractor Licensing and Training ................................................................. 2-4
      2.2.3.2 Contractor Personnel ....................................................................................... 2-5
    2.2.4 Port Consultants ....................................................................................................... 2-8
    2.2.5 Construction Support Consultants to Port ............................................................. 2-9

3 Reporting Activities ........................................................................................................... 3-1
  3.1 Pre-Construction Documentation .................................................................................. 3-1
    3.1.1 Removal Action Work Plan ....................................................................................... 3-1
      3.1.1.1 Project Approach .............................................................................................. 3-2
      3.1.1.2 Baseline Schedule ........................................................................................... 3-3
      3.1.1.3 Site-specific Construction Health and Safety Plan ............................................ 3-3
      3.1.1.4 Traffic Control Plan ......................................................................................... 3-3
      3.1.1.5 Pollution Prevention Plan ................................................................................. 3-3
      3.1.1.6 Erosion and Sedimentation Control Plan ........................................................ 3-3
      3.1.1.7 Green and Sustainable Remediation Plan ....................................................... 3-4
      3.1.1.8 Construction Quality Control Plan ................................................................. 3-4
      3.1.1.9 Transportation and Disposal Plan .................................................................... 3-4
      3.1.1.10 Survey Plan ...................................................................................................... 3-5
      3.1.1.11 Excavation Support System Plan .................................................................... 3-5
      3.1.1.12 Construction Water Management Plan .......................................................... 3-5
      3.1.1.13 Settlement Monitoring Plan .......................................................................... 3-5
      3.1.1.14 Dewatering Plan ............................................................................................. 3-6
      3.1.1.15 Earthwork Plan ............................................................................................... 3-6
      3.1.1.16 Soil Stockpile Plan .......................................................................................... 3-6
      3.1.1.17 Dredging Plan ................................................................................................. 3-7
      3.1.1.18 Demolition Plan .............................................................................................. 3-7
      3.1.1.19 Deconstruction Plan ...................................................................................... 3-8
      3.1.1.20 Vessel Management Plan .............................................................................. 3-8
      3.1.1.21 Sheet Pile Driving Plan ................................................................................... 3-8
3.1.1.22 Final Water Quality Monitoring Plan .................. 3-8
3.1.1.23 Construction Checklist ........................................ 3-9
3.1.1.24 Contractor’s Daily Construction Report Form ........ 3-9
3.1.2 Final RAWP ............................................................. 3-9

3.2 Construction Documentation ........................................... 3-9
3.2.1 Contractor’s Daily Construction Report ..................... 3-9
3.2.2 Weekly Quality Assurance Report ................................ 3-10
3.2.3 Water Quality Monitoring Summaries ....................... 3-11
3.2.4 Air, Noise, and Light Monitoring Summaries .......... 3-11
3.2.5 Hydrographic and Topographic Survey Reporting .... 3-11
3.2.6 Waste Characterization Testing Reports and Manifests .. 3-12
3.2.7 Import Material Characterization Reports .............. 3-13
3.2.8 Field Change Documentation ..................................... 3-13

3.3 Post-Construction Documentation .................................. 3-14
3.3.1 Record Drawings, Manuals, and Certifications ....... 3-14
3.3.2 Pre-Final Inspection and Punch List ....................... 3-14
3.3.3 Final Inspection Report ............................................. 3-14

4 Removal Action Construction Elements .................................. 4-1
4.1 Summary of Inspection and Monitoring Tasks .............. 4-1
4.2 Survey Controls and Project Limits .............................. 4-4
4.2.1 Description ............................................................. 4-4
4.2.2 Quality Control Measures ........................................ 4-5
4.2.3 Environmental Controls, Monitoring, and Corrective Action 4-5
4.3 Installation of Sheet Pile Wall ........................................ 4-5
4.3.1 Description ............................................................. 4-5
4.3.2 Quality Control Measures ........................................ 4-6
4.3.3 Environmental Controls, Monitoring, and Corrective Action 4-6
4.4 Demolition and Removal .............................................. 4-7
4.4.1 Description ............................................................. 4-7
4.4.2 Quality Control Measures ........................................ 4-7
4.4.3 Environmental Controls, Monitoring, and Corrective Action 4-8
4.5 Dredging and Excavation ............................................. 4-8
4.5.1 Description ............................................................. 4-8
4.5.2 Quality Control Measures ........................................ 4-9
4.5.2.1 Achieving Specified Dredging Depths, Slopes, and Limits 4-9
4.5.2.2 Hydrographic and Topographic Surveys .............. 4-9
4.5.2.3 Dredge Positioning Controls ............................... 4-10
4.5.2.4 Minimizing Residuals and Turbidity from In-water Activities 4-10
4.5.3 Environmental Controls, Monitoring, and Corrective Action4-11
4.5.3.1 Achieving Toxic Substances Control Act Soil Excavation 4-11
4.5.3.2 Achieving Removal Action Levels ..........................4-11

4.6 Transportation and Disposal of Dredged Sediments ..........................4-21
4.6.1 Description .........................................................................4-21
4.6.2 Quality Control Measures ..................................................4-21
4.6.2.1 Waste Tracking .............................................................4-22
4.6.3 Environmental Controls, Monitoring, and Corrective Action 4-22

4.7 Shoring ..................................................................................4-23
4.7.1 Description .........................................................................4-23
4.7.2 Quality Control Measures ..................................................4-23
4.7.3 Environmental Controls, Monitoring, and Corrective Action 4-23

4.8 Stockpiling and Dewatering of Soil .............................................4-24
4.8.1 Description .........................................................................4-24
4.8.2 Quality Control Measures ..................................................4-24
4.8.3 Environmental Controls, Monitoring, and Corrective Action 4-24

4.9 Characterization of North Building Soils .................................4-26
4.9.1 Description .........................................................................4-26
4.9.2 Quality Control Measures ..................................................4-26
4.9.3 Environmental Controls, Monitoring, and Corrective Action 4-27

4.10 Placement of Soil Backfill .....................................................4-27
4.10.1 Description .........................................................................4-27
4.10.2 Quality Control Measures ..................................................4-27
4.10.3 Environmental Controls, Monitoring, and Corrective Action 4-28

4.11 Placement of Sediment Backfill ..............................................4-29
4.11.1 Description .........................................................................4-29
4.11.2 Quality Control Measures ..................................................4-29
4.11.2.1 Thickness and Extent .......................................................4-30
4.11.2.2 Verification of Import Material Quality .........................4-30
4.11.2.3 Limiting Turbidity Generation ........................................4-31
4.11.3 Environmental Controls, Monitoring, and Corrective Action 4-31

4.12 Reuse of Existing Backfill .....................................................4-32
4.12.1 Description .........................................................................4-32
4.12.2 Quality Control Measures ..................................................4-32
4.12.3 Environmental Controls, Monitoring, and Corrective Action 4-32

4.13 Pile Driving ...........................................................................4-32
4.13.1 Description .........................................................................4-32
4.13.2 Quality Control Measures ..................................................4-32
4.13.3 Environmental Controls, Monitoring, and Corrective Action 4-33

4.14 Relocation of South Park Marina Floats ....................................4-33
4.14.1 Description .........................................................................4-33
4.14.2 Quality Control Measures ..................................................4-34
4.14.3 Environmental Controls, Monitoring, and Corrective Action

References

5-1
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1</td>
<td>Construction Elements and Monitoring</td>
</tr>
<tr>
<td>4-2</td>
<td>Removal Action Levels</td>
</tr>
<tr>
<td>4-3</td>
<td>Pre-Confirmation Data from Nine Deep Excavation Grid Cells Included in Confirmation Dataset</td>
</tr>
<tr>
<td>4-4</td>
<td>Gradation Requirements for Backfill Materials</td>
</tr>
</tbody>
</table>

List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1</td>
<td>Construction Management Team Organization Chart</td>
</tr>
<tr>
<td>4-1</td>
<td>Excavation Plan</td>
</tr>
<tr>
<td>4-2</td>
<td>Confirmation Sampling Locations, Upland Grid, and Perimeter Sediment Sampling Locations</td>
</tr>
</tbody>
</table>

List of Attachments

Attachment A Draft Quality Assurance Project Plan
# Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACOM</td>
<td>Agency Construction Oversight Manager</td>
</tr>
<tr>
<td>ARAR</td>
<td>Applicable or Relevant and Appropriate Requirement</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>BMP</td>
<td>best management practice</td>
</tr>
<tr>
<td>BTEX</td>
<td>benzene, toluene, ethylbenzene, and xylenes</td>
</tr>
<tr>
<td>CDL</td>
<td>Commercial Driver’s License</td>
</tr>
<tr>
<td>CESCL</td>
<td>Certified Erosion and Sediment Control Lead</td>
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<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
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<tr>
<td>CIC</td>
<td>Community Involvement Coordinator</td>
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<tr>
<td>CIP</td>
<td>Community Involvement Plan</td>
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<tr>
<td>City</td>
<td>City of Seattle</td>
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<tr>
<td>COC</td>
<td>contaminant of concern</td>
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<tr>
<td>Contractor</td>
<td>prime construction contractor</td>
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<tr>
<td>cPAH</td>
<td>carcinogenic polycyclic aromatic hydrocarbons</td>
</tr>
<tr>
<td>CHASP</td>
<td>Community Health and Safety Plan</td>
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<tr>
<td>CQAP</td>
<td>Construction Quality Assurance Plan</td>
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<tr>
<td>CQCP</td>
<td>Construction Quality Control Plan</td>
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<tr>
<td>CS</td>
<td>Contractor Superintendent</td>
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<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>cy</td>
<td>cubic yard</td>
</tr>
<tr>
<td>DL</td>
<td>Design Lead</td>
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<tr>
<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>EAA</td>
<td>Early Action Area</td>
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<tr>
<td>ECCL</td>
<td>Environmental Compliance and Community Liaison</td>
</tr>
<tr>
<td>ECM</td>
<td>Environmental Compliance Manager</td>
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<tr>
<td>Ecology</td>
<td>Washington Department of Ecology</td>
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<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
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<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
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<tr>
<td>FSP</td>
<td>Field Sampling Plan</td>
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<tr>
<td>GSR</td>
<td>Green and Sustainable Remediation</td>
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<tr>
<td>HASP</td>
<td>Health and Safety Plan</td>
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<tr>
<td>HAZWOPER</td>
<td>Hazardous Waste and Emergency Operation</td>
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<tr>
<td>IFCI</td>
<td>International Fire Code Institute</td>
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<tr>
<td>JMP</td>
<td>Joint Management Plan</td>
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<tr>
<td>LDW</td>
<td>Lower Duwamish Waterway</td>
</tr>
<tr>
<td>Marina</td>
<td>South Park Marina</td>
</tr>
<tr>
<td>MLLW</td>
<td>mean lower low water</td>
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<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
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</tbody>
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NTCRA  non-time-critical removal action  
PCB  polychlorinated biphenyl  
PE  (Contractor) Project Engineer  
Phase 1  Sediment and Upland Areas  
Phase 2  Adjacent Streets and Yards Areas  
PM  Project Manager  
Port  Port of Seattle  
PPC  Port Project Coordinator  
PPM  Port Project Manager  
PRG  Preliminary Remediation Goal  
Project  Phase 1 cleanup  
QA  quality assurance  
QAM  Quality Assurance Manager  
QAO  Quality Assurance Officer  
QAPP  Quality Assurance Project Plan  
QC  quality control  
QCR  Quality Control Representative  
RACL  Resource Agency Consultation Lead  
RAO  remedial action objective  
RAWP  Removal Action Work Plan  
RCW  Revised Code of Washington  
RE  Resident Engineer  
RPM  Remedial Project Manager  
RTK-GPS  real time kinematic global positioning system  
RvAL  removal action level  
SAP  Sampling and Analysis Plan  
Settlement Agreement  Administrative Settlement Agreement and Order on Consent  
SHSS  Site Health and Safety Supervisor  
SMS  Sediment Management Standard  
SOW  Statement of Work  
SQS  Sediment Quality Standard  
SWPPP  Stormwater Pollution Prevention Plan  
T-117  Terminal 117  
TL  Technical Lead  
TOC  total organic carbon  
TPH  total petroleum hydrocarbons  
TSCA  Toxic Substances Control Act  
UCL  upper confidence limit  
USACE  United States Army Corps of Engineers  
UST  underground storage tank  
VSP  Visual Sample Plan
<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAC</td>
<td>Washington Administrative Code</td>
</tr>
<tr>
<td>WQC</td>
<td>Water Quality Certification</td>
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<tr>
<td>WQMP</td>
<td>Water Quality Monitoring Plan</td>
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<tr>
<td>WQS</td>
<td>Water Quality Specialist</td>
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</tbody>
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1 Introduction

The non-time-critical removal action (NTCRA) for the Terminal 117 (T-117) Sediment and Upland Area (Phase 1) will begin in summer 2013. The goals of the sediment dredging and soil removal are to protect ecological and human health from elevated contaminant of concern (COC) concentrations in sediment and soil. The T-117 site is an Early Action Area (EAA) within the 440-acre Lower Duwamish Waterway (LDW) Superfund site. Dredging of the Sediment Area will help achieve the remedial action objectives (RAOs) for the LDW Superfund site. The RAOs are to protect human health, wildlife, and benthic invertebrates from exposure to COCs through seafood consumption and direct contact with sediments.

LDW-wide COCs driving the risk to these receptors are total polychlorinated biphenyls (PCBs), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), arsenic, dioxins/furans, and the Sediment Management Standard (SMS) chemicals. Of these risk drivers, T-117 has sediment removal action levels (RvALs) for arsenic, 2-methyl naphthalene, acenaphthene, anthracene, cPAH, dibenzofuran, fluoranthene, fluorene, phenanthrene, phenol, total PCBs, and dioxins/furans. In the Upland Area, soil RvALs are for total PCBs, arsenic, silver, cPAH, dioxins/furans, and total petroleum hydrocarbon (TPH). Detected RvAL exceedances of the COCs were used to delineate the soil and sediment excavations, and confirmation sampling of these COCs will be used to confirm excavation completion.

This draft Construction Quality Assurance Plan (CQAP) describes the means to assure achievement of RvALs and protection of community health and the environment during removal activities. It will be finalized using the Contractor’s specific plan for excavation, dredging, and other activities during the Removal Action Work Plan (RAWP). The United States Environmental Protection Agency’s (EPA) Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA 2005), EPA’s Methods for Evaluating the Attainment of Cleanup Standards (EPA 1989), Washington Department of Ecology’s (Ecology) Sediment Cleanup Standards User Manual (Ecology 1991), and all Applicable or Relevant and Appropriate Requirements (ARARs) were reviewed in the development of this plan.

1.1 Activities Addressed by this Plan

As identified in the Administrative Settlement Agreement and Order on Consent (Settlement Agreement), this CQAP describes the cleanup confirmation methods for this NTCRA. It describes the collection and analysis of data used to determine the adequacy/completeness of soil and sediment removal and backfilling. As illustrated in the design grades on Drawing C005, approximately 8,100 cubic yards (cy) of sediment will be dredged from the T-117 Sediment Area to final elevations ranging from -2 ft mean lower low water (MLLW) to -13 ft MLLW. Upland soil (35,100 cy of non-Toxics Substances Control Act [TSCA] and 2,900 cy of TSCA\textsuperscript{1} soil) will be excavated from the Upland Area, which will be backfilled to elevations ranging from +20 (along the adjacent street right-of-way) to +14

\textsuperscript{1} Total PCBs exceed 50 mg/kg dw.
ft MLLW (to the top of the bank). Cleanup passes triggered by RvAL exceedances in confirmation data will increase the volumes of soil/sediment removed and the volumes of backfill needed. Additional excavation may cause work hours to be extended, especially for dredging, so that the schedule is met. The following activities will accompany site cleanup:

- Demolition of buildings and foundations
- Abandonment of groundwater monitoring wells
- Removal of asphalt pavement and concrete slabs
- Removal of buried upland debris and structures such as concrete, metal, septic tank and drain field, piping, utilities, closed-in-place underground storage tanks (UST), and an un-closed UST under the North Building
- Disconnection or protection of public utilities
- Collection, treatment, monitoring, and discharge of groundwater pumped from deep excavations and from within the sheet pile wall enclosure, site stormwater, water that drains from wet soil in bermed stockpile areas, and decontamination fluids
- Installation of a sheet pile wall at existing elevation +2 ft MLLW and parallel to the middle portion of the bank and with side walls extending from the outer wall into the upland (perpendicular to the bank)
- Removal of in-water piles, debris, and a debris deflector
- If needed for vessel maneuvering, removal and replacement of marina floats. Piles would be removed and replaced with new steel piles. Transport, temporary moorage, and replacement of vessels and floats will be conducted by the Marina owner.
- Placement of a new debris deflector consisting of four steel piles and a horizontal floating arm
- Backfilling of all excavated/dredged areas of T-117 and the Marina bank.

### 1.1.1 Schedule

Phase I removal actions include the following activities from spring 2013 through spring 2014:

- Spring 2013: Mobilization, placement of temporary facilities and controls, and building demolition/deconstruction
- Summer 2013: Upland demolition and removal of bank piles and debris, installation of shoreline barrier, and upland and bank soil excavation
- Fall 2013: Removal of Sediment Area piles, debris, debris deflector, and South Park Marina (Marina) piles and floats
- Winter 2013/2014: Dredging and backfilling of the Sediment Area, bank and upland backfill completion, and replacement of Marina piles, floats, and debris deflector.
- Spring 2014: Site completion, pre-certification inspections, and demobilization.
1.2 Document Organization

This CQAP contains the following sections: Project Organization and Responsibilities (Section 2), Reporting (Section 3), and Removal Action Construction Elements with their associated measurement/monitoring (Section 4). Section 4 also discusses the decision criteria for the use of soil and sediment chemical data to confirm successful excavation and the data that will be used to assess completeness of the construction elements. Attachment A is the Quality Assurance Project Plan (QAPP) for collection of soil and riverbank sediment samples used to confirm excavation completion and for the collection of treated water discharge samples. It includes the data quality objectives for this work.
2 Project Organization and Responsibilities

The cleanup will be conducted in two separate but coordinated phases: the Sediment and Upland Areas cleanup (Phase 1) and the Adjacent Streets and Residential Yards Area cleanup (Phase 2). The Port of Seattle (Port) is managing the work associated with the cleanup for the Phase 1 Sediment and Upland Areas while the City of Seattle (City) is managing work associated with the cleanup for the Phase 2 Adjacent Streets and Residential Yards Area. EPA has lead responsibility for regulatory oversight. Port Construction Management and EPA will oversee the work. The Port has hired environmental consultants to provide removal design and technical assistance during construction; similarly a general Contractor will be selected under a Public Works process to implement the work. Each of the project responsibilities are described in further detail below. Figure 2-1 summarizes the Project roles and responsibilities.

2.1 Teams

- Design Team – prior to construction, this team, comprised of the Port, City, EPA, any agencies supporting EPA (such as the United States Army Corps of Engineers [USACE]), and the Port and City’s consultants, is responsible for preparing all design plans, drawings, specifications, and reports that the Contractor is to implement.

- Construction Management Team - once the work begins, this team will include the Contractor, any subcontractors hired by the Contractor, the Port, Port consultants, EPA, and the U.S. Army Corps of Engineers (USACE). This team will complete all QA/QC activities to ensure that the NTCRA is completed sufficiently and the removal action objectives are achieved while community and worker health and the environment are protected (Figure 2-1).

2.2 Personnel Responsibilities

2.2.1 Environmental Protection Agency

The EPA is the regulatory authority and responsible agency for overseeing and authorizing the removal design and action. In this capacity, EPA will review and approve the design documents and the RAWP. Other contractor submittals (described in Section 4 of this CQAP) will be included in the RAWP and reviewed by EPA to ensure that the Contractor’s quality assurance/quality control (QA/QC) program is consistent with the removal design objectives. EPA, the Port, and City will jointly resolve unforeseen problems, potentially changing construction activities. In addition, the following EPA staff will have key roles in this project.

The Remedial Project Manager (RPM; Ms. Piper Peterson) will be responsible for overseeing the removal action to ensure that the removal action meets removal action objectives and is implemented in accordance with the Statement of Work (SOW).
An Agency Construction Oversight Manager (ACOM; USACE) will be designated to exercise project oversight for EPA and to coordinate with the Port and City. The ACOM will oversee the construction activities relative to the SOW, design drawings and specifications, and the approved RAWP.

The Water Quality Specialist (WQS; Ericka Hoffman) will support the RPM, develop EPA’s Water Quality Certification (WQC), and make technical decisions regarding water quality monitoring results and response actions. The communication and feedback mechanisms for these decisions are described in the draft Water Quality Monitoring Plan (WQMP).

The Quality Assurance Manager (QAM; EPA) will oversee data collection and analysis. The QAM will review the QAPPs for this CQAP (Attachment A) and for the WQMP to determine compliance with data quality objectives.

### 2.2.2 Port of Seattle

The Port Project Coordinator (PPC; Roy Kuroiwa) will:
- Act as the primary point of contact with EPA for this Phase I work
- Coordinate community involvement activities among Port, City, consultants, and EPA, in accordance with the Community Involvement Plan (CIP)
- Review community involvement documents.

The Port Project Manager (PPM; Ticson Mach) will be responsible for internal Port coordination of contracting and construction management. The PPM will manage all scheduling and coordination of Port resources as needed to ensure Contractor procurement and execution of the contract. Coordination activities include but are not limited to:
- Management of design consulting team
- Bid/design strategy development with design team
- Project schedule and budget tracking
- Coordination of design team activities with internal Port activities, including engineering, construction, surveying, and procurement.

The Port Resident Engineer (RE; Stacy Heilgeist) will be responsible for the following:
- Management of bid documents and execution of the Project
- Management of construction QA activities and associated deliverables
- Interaction with and direction to the Contractor, including claims.

The RE will be the primary means of contact with the Contractor and will be the only individual to direct the Contractor or modify Contractor activities on the Port’s behalf. All communications regarding QA elements that may modify Contractor activities will go through the RE.
The Port Environmental Compliance and Community Liaison (ECCL; Dave Jenkins) will be responsible for the following:

- Compliance with bid document environmental requirements
- Management of Community Health and Safety Plan (CHASP)-related performance issues with Contractor
- Coordination of CHASP performance reporting with Community Involvement Coordinator and Project Coordinator.

The Community Involvement Coordinator (CIC; Sally del Fierro) will be responsible for the following:

- Community involvement coordination between T-117 activities and other Port efforts, in accordance with the (CIP)
- Review of community involvement materials.

The Port’s Technical Lead (TL; Kym Anderson) will be responsible for the following:

- Coordinating with RE on design issues
- Reviewing technical documents prepared for EPA submittal
- Providing direction to RE on construction QC and reporting activities.

The Port’s Resource Agency Consultation Lead (RACL; Jon Sloan) will be responsible for the following:

- Primary point of contact with resources agencies (National Marine Fisheries Service and United States Fish and Wildlife Service), Tribes, and USACE
- Lead Endangered Species Act (ESA) Biological Assessment and review related technical documents
- Ensure that water quality monitoring follows the EPA-approved WQMP and the WQC and that monitoring is protective of biological resources.

### 2.2.3 Contractor

The Contractor will perform the removal activities, including, but not limited to, demolition of buildings and structures, removal of piles and debris, dredging, excavation, transport and disposal of dredged sediments and upland soil, and placement of backfill. The Contractor will monitor in-water and treated water discharge, water quality monitoring, as well as monitoring of settlement points, the activities of any subcontractors, and any worker health and safety-related items. The Contractor will comply with any BMPs to protect community health and safety (as described in the CHASP; Attachment G of the Design Report), and will adjust practices in response to air, noise, and light monitoring data collected by the Port. Any adjustments to work will occur at the direction of the Port RE.

These activities will be conducted in accordance with the EPA-approved contract drawings, specifications, and the RAWP, which includes several Contractor-written plans. Specific
Contractor personnel and functions, as well as any subcontractors under the direction of the Contractor, will be described in the RAWP submittals. The RAWP describes the Contractor’s plan for completing the removal activities. Elements in this CQAP will be adjusted such that they are appropriate given the Contractor’s specific methods for completing the work. For example, the specific staging of soil and sediment removal and subsequent backfilling activities will guide the timing/sequencing of confirmation sample collection.

2.2.3.1 Contractor Licensing and Training

All site Contractor and subcontractor personnel will be required to have current health and safety training required by the Washington State Department of Labor and Industries (Chapter 296-2 Washington Administrative Code [WAC], Subpart P, Hazardous Waste Operations and Emergency Response [HAZWOPER]), including specific onsite training. The exception to this may include truck drivers and third-party surveyors if their roles do not place them in potential contact with contaminated materials/soil.

Per the Revised Code of Washington (RCW) 46.25.070 through -085, any truck drivers transporting hazardous (TSCA-level) soil, sediment, or debris from the site must have a Commercial Driver’s License (CDL) with a hazardous materials (“H”) endorsement issued by the state of Washington.

A UST is to be decommissioned and then removed from below the North Building. The Contractor’s staff or a subcontractor who oversees or performs this work (closing and removing the UST) must have a certification from the International Fire Code Institute (IFCI).

The Contractor is responsible for following all local, state, and federal laws related to licensing and training. At a minimum, the Contractor will conduct the following activities:

- Obtain a business license from the appropriate jurisdiction in which the work is being performed.
- Comply with the Port Construction Safety & Health Manual, all OSHA and WISHA requirements and amendments, and the following chapters of WAC:
  - Chapter 296-24 General Safety and Health Standards.
  - Chapter 296-62 General Occupational Health Standards.
  - Chapter 296-155 Safety Standards for Construction Work.
  - Chapter 296-800 Safety & Health Core Rules
- Comply with the following requirements when they are applicable:
  - American National Standards Institute and American Society of Safety Engineers standards
  - Local building and construction codes
  - United States Coast Guard requirements
  - Seattle Fire Department codes
  - National Fire Protection Act 70E
National Electrical Code.

2.2.3.2 Contractor Personnel

Contractor roles are defined in specification Section 01308 – Contractor Project Organization. The Contractor’s Project Manager (PM) will report directly to the Port RE. The Contractor’s PM provides management of and direction to all Contractor and subcontractor personnel, and has overall responsibility for executing the work in compliance with the contract and the RAWP. The PM will have experience as a superintendent or engineer for at least five projects involving upland excavation and sediment dredging, and will have been a PM for at least one successful project within the last five years.

Depending on the number of staff, some of the following roles may be filled by the same person. The Contractor Superintendent (CS) will provide onsite management of and direction to the Contractor’s and subcontractor’s personnel. The CS may not be the same person as the PM, and the CS will be responsible for executing the work in full compliance with the contract drawings and specifications. In addition, the CS will verify proper operation and maintenance of equipment, manage subcontractors, and provide daily reports to the RE. The CS will be responsible for:

- Coordinating with home office staff
- Managing and coordinating all removal action subcontractors on the site
- Ensuring completion of the construction in accordance with the contract documents, applicable codes and standards, and the approved RAWP
- Ensuring completion of the project on schedule and within budget
- Ensuring that appropriate change management procedures are in place
- Ensuring that adequate site security, appropriate for the activities being performed, is maintained
- Ensuring that construction equipment is properly serviced and used
- Ensuring that an adequate labor force is assigned to the project with the proper training, education, experience, skills, tools, equipment, and materials to complete the construction and minimize potential impacts to the environment
- Preparing and submitting (electronically) the daily construction report to the Port’s RE
- Revising activities in response to monitoring data, accidents, emergencies, or community complaints.

The Contractor Quality Control Representative (QCR) will be responsible for implementation and maintenance of the Construction Quality Control Plan (CQCP). Responsibilities of the QCR include, but are not limited to:

- Providing and maintaining an effective QC system for all construction tasks
• Coordinating QC monitoring and testing activities and preparing construction submittals
• Monitoring QC activities to ensure conformance with authorized policies, procedures, Contractor plans (such as the Pollution Prevention Planning and Execution Plan) and sound construction practices, as well as recommending improvements, as necessary
• Conducting the weekly QC meeting and submitting the meeting minutes electronically to the RE and the Contractor PM
• Conducting other meetings with the construction team covering the requirements of the QC procedures, the CQCP, and this CQAP, as appropriate
• Informing, identifying, and resolving non-conformances
• Conducting the weekly QC meeting and submitting the meeting minutes electronically to the RE and the Contractor PM
• Conducting other meetings with the construction team covering the requirements of the QC procedures, the CQCP, and this CQAP, as appropriate
• Informing, identifying, and resolving non-conformances
• Recommending stop work, or re-performance of any nonconforming activity resulting from improper application of prescribed procedures
• Maintaining awareness of the entire project to detect conditions that may adversely affect quality
• Monitoring corrective action documentation for conditions adverse to quality, verifying implementation of corrective actions, tracking and analyzing corrective actions, and providing corrective action documentation upon completion
• Preparing and submitting electronically the daily construction QC reports to the RE
• Responding to action level exceedances identified by the CHASP and the WQMP, as directed by the Port RE.

The Contractor Project Engineer (PE) is responsible for the daily performance of field QC activities in support of the Project. The Contractor PE will work with onsite office staff. Duties of the Contractor PE include, but are not limited to:
• Ensuring that all records, logs, manifests, permits, required regulatory documentation (e.g., discharge monitoring reports, inspections), sample results, laboratory reports, manufacturers’ instructions, warranties, standard procedures, and project plans are maintained and stored in a retrievable fashion and that controlled copies of standard procedures, project specifications, and project plans are available to all appropriate personnel
• Ensuring that training records of site personnel, including craft labor, are maintained in accordance with government regulations
• Ensuring that approved design documents are used for construction
• Ensuring accurate interpretation and application of design documents, codes, and standards governing design implementation
• Ensuring that temporary support systems are designed and implemented in accordance with the contract documents and applicable regulations
• Conducting acceptance and performance testing of installed equipment, materials, and systems in accordance with the specifications
• Preparing and tracking field change requests when required to obtain design engineering approval of requested field changes
• Providing appropriate technical guidance to the craft supervision and labor forces in the completion of construction efforts
• Coordinating the permitting process
• Maintaining record drawings and construction red-line drawings
• Taking progress photographs and assisting with preparation of monthly progress reports
• Performing and/or coordinating construction surveying and layout
• Preparing and submitting (electronically) the monthly rework items list, monthly test plan and log, and monthly Submittal Register to the Port
• Providing input to daily reports.

The Contractor PE will be a licensed Professional Engineer in the state of Washington.

The Contractor Site Health and Safety Supervisor (SHSS) will fulfill the duties and responsibilities of the environmental and safety supervisor. The SHSS will ensure that operations are performed in compliance with applicable client and site-specific requirements and government regulations. The SHSS will be responsible for the following:

• Supervising the site health and safety of construction personnel relative to site compliance with all applicable regulations
• Ensuring that construction team members understand the requirements of the health and safety requirements for work on the site through training and communications
• Conducting daily health and safety briefings
• Exercising stop work authority when warranted by conditions
• Ensuring that site personnel have received required training and maintaining documentation of such training on the project site
• Supporting the Contractor SS in response to accidents, complaints, and incidences
• Functioning as a technical resource for all environmental, safety, loss, industrial, and hygiene issues.

The Contractor Environmental Compliance Manager (ECM) will:
• Be onsite at all times. If construction occurs during more than one shift in 24 hours, the Contractor PE will be onsite.
• Report to the PE and will have direct, day-to-day control and oversight of the RAWP
• Oversee all inspections, documentation, recordkeeping, reporting, submittals, modifications, schedules and other requirements of the RAWP (e.g., GSR metrics,
water treatment plant discharge monitoring, settlement monitoring), as directed by the PE.

- Attend all RAWP meetings, as directed by the PE.
- Have no duties other than daily oversight of the RAWP
- Have three years proven experience with construction stormwater and dewatering management, including oversight of treatment systems designed to remove PCBs, metals, turbidity, and other contaminants
- Have proven oversight responsibilities for at least one cleanup project under EPA or state oversight in the past five years.
- Be an Ecology-Certified Erosion and Sediment Control Lead (CESCL).

Contractor staff must also include dredging personnel (Dredging PM, Dredging Project Superintendent, and Dredging Operator), a surveying team, an Environmental Compliance Inspector, Construction Water Manager, and a Shoring Design Engineer. These staff must have appropriate training/certifications such as Coast Guard approved vessel operation training for the Dredging Operator.

Other site personnel (craft labor) may be added as deemed necessary by the Contractor. Additional responsibilities of the Contractor personnel will be determined by the Contractor.

The RAWP will identify any subcontractors the Contractor intends to employ in the work. The subcontractors are responsible to the Contractor for the quality of their work, protection of the environment, and the health and safety of their personnel to the same level that the Contractor is responsible. The subcontractor’s principals will designate a job site foreman who will coordinate with the Contractor and will be responsible for the quality of the work.

The Contractor will employ an independent licensed land surveyor as a subcontractor for key surveying tasks, acceptance of the work (dredging, excavation, and backfilling), and preparation of record drawings. The independent surveyor will be a licensed land surveyor in the state of Washington qualified in hydrographic survey work, as defined in Section 01722 of the specifications.

The Contractor will use an EPA approved analytical laboratory for chemical testing requirements. The Contractor’s laboratory must adhere to the requirements of Specification Section 01451‐ Quality Control; Testing Laboratory Services.

### 2.2.4 Port Consultants

As the prime design consultant to the Port (Design Lead; DL), CRETE Consulting, Inc. (CRETE) is responsible for designing all site activities, for managing the preparation of
relevant documents, and for managing/coordinate design subconsultants. CRETE will also be a part of the Construction Management Team as the DL.

The Port will hire a consultant to perform construction oversight, including confirmation sampling, documentation, and community outreach support throughout construction. Consultant staff will include field staff and a Quality Assurance Officer (QAO), who will review the confirmation data and determine when excavation is complete in each decision unit (soil grid cell, sediment dredging unit, or riverbank unit). This consultant and the Port RE will confer on these data and make risk management decision as the confirmation dataset is developed. Some early decisions, to allow backfilling, may need to be made before the entire dataset (against which compliance is evaluated) is available.

Grette Associates is responsible for developing the WQMP, which guides water quality monitoring during all in-water activities. The EPA-provided WQC will be the binding document regulating water quality monitoring, and it will be followed by the Contractor. Grette Associates also prepared the ESA Section 7 Biological Assessment, which assesses the potential for adverse impacts to salmonids.

EMB Consulting is responsible for developing portions of the CHASP related to community protection from potential air quality, light, and noise impacts. The Contractor is required to comply with the performance requirements in the CHASP. The Contractor may need to modify site activities, under the direction of the Port RE, if performance standards in the Air, Noise, and Light Monitoring Plan are exceeded and/or if modifications of the plan become necessary based on feedback during construction.

Moffat & Nichol is responsible for design of the Marina elements and verification of the quality of replacement piles used to relocate sections of a marina dock following Sediment Area activities, if the floats are replaced.

Jacobs Associates is responsible for all geotechnical design, including verification of the quality of the sheet pile wall installed to isolate the middle portion of the bank.

Cultural Resources Consultants, Inc. has developed a plan for identifying cultural resources that may be discovered during excavation activities. The plan describes areas and lithological or fill units of the site that have the potential to contain cultural resources and actions to be taken if such materials are identified.

### 2.2.5 Construction Support Consultants to Port

The Port will select a team to provide construction support. These activities include: sediment and soil confirmation sampling, community health and safety monitoring, community outreach, construction oversight, laboratory analysis, and preparation of completion reports.
Figure 2-1 Construction Management Team Organization Chart

Key
solid line = general communication flow
dashed line = Port of Seattle Resource Agency Consultation Lead also communicates directly with permitting agencies.
3 Reporting Activities

Prior to the start of construction, various documents will be prepared by the Port, CRETE, and the Contractor to design and support the construction activities. The Contractor will generate most documents during construction and will be responsible for QC during construction. The Contractor, RE, and QAO will be responsible for QA (i.e., to verify that the required QC measures have been implemented). Contractor submittals are discussed below. Additional details are provided in the contract specifications.

3.1 Pre-Construction Documentation

3.1.1 Removal Action Work Plan

The RAWP will be prepared in accordance with the Settlement Agreement. Following Contractor selection, the RAWP is anticipated to be submitted to EPA by March 1, 2013. The parties responsible for transloading, transportation, and disposal will be subcontractors to the construction Contractor, and the bid package will cover all aspects of the removal action.

The RAWP will outline the implementation of the removal action, including how the construction activities will be implemented and coordinated with EPA. The RAWP and its accompanying plans will be written by the Contractor. The Port team will review the Contractor’s RAWP and add any additional required information and may edit it so that it is comprehensive and meets all of the SOW and specification requirements. The Contractor’s RAWP will include specific plans for completing the work. At a minimum, the RAWP will include the following elements:

- Description of removal action and construction activities
- Description of transloading, transportation, and disposal activities
- Schedule of activities for completion of removal action
- Formulation of removal action team and project personnel
- Coordination with EPA’s Off-Site Rule
- Procedures for processing design changes and securing EPA approval
- The CQCP
- Site-specific Construction Health and Safety Plan (HASP)
- A Green and Sustainable Remediation (GSR) Plan, which will document methods to reduce waste generation, resource use, and emissions. It will also describe accounting of reductions/savings achieved through the Contractor’s activities.

The following Design Team-generated documents will also be in the RAWP:

- This CQAP (including QAPP)
- CHASP (including Air, Noise, and Light Monitoring Plan).

The following Contractor documents comprising the RAWP will describe the construction activities and the specific means, methods, schedules, and personnel necessary to
complete the work; the identified section of the specifications includes the required elements of each plan:

- Project Approach (Section 01400)
- Baseline Schedule (Section 01400)
- Site-specific Construction HASP (Section 01860)
- Traffic Control Plan (Section 01570)
- Pollution Prevention Plan (Section 01631)
- Contractor’s Erosion and Sedimentation Control Plan (Section 02270)
- Green and Sustainable Remediation Plan (Section 01400)
- Contractor’s Quality Control Plan (Section 01451)
- Transportation and Disposal Plan (Section 02111)
- Survey Plan (Section 01722)
- Excavation Support System Plan (Section 02217)
- Construction Water Management Plan (Section 02245)
- Settlement Monitoring Plan (Section 02340)
- Dewatering Plan (Section 02525)
- Earthwork Plan (Section 02300)
- Soil Stockpile Plan (Section 02114)
- Dredging Plan (Section 02325)
- Demolition Plan (Section 02220)
- Deconstruction Plan (Section 02227)
- Vessel Management Plan (Section 02325)
- Sheet Pile Driving Plan (Section 02454)
- Final Water Quality Monitoring Plan (WQMP; 01400)
- Construction Checklist (01400)
- Contractor’s Daily Construction Report Form (01400).

Construction QA/QC procedures will be addressed in various elements of the RAWP. Section 01400 of the specifications provides detailed RAWP requirements. In some cases, additional requirements are referenced in related sections of the specifications. A brief description of the contents of each component of the RAWP is provided below.

### 3.1.1.1 Project Approach

The RAWP will be prepared in accordance with Section 01400, and its Project Approach will describe, in narrative form, the methods to be employed in the removal action, including equipment types, modes of operation, general schedules, sequence of activities, proposed personnel and subcontractors, disposal facilities and materials suppliers, transloading location, and other aspects necessary to describe how and when the specified work will be performed. The Project Approach will also describe all temporary facilities and stockpile,
staging, and access areas, including work areas, on-site equipment and material storage areas, transloading, access and haul routes, and parking areas. A related Section (01308), project organization, will describe the Contractor’s personnel and subcontractors to be used for the project, including an organizational chart.

3.1.1.2 Baseline Schedule

The project schedule will be included in the RAWP (Section 01400). A detailed initial critical path project schedule will be submitted by the Contractor showing the deliverables and each construction element. Periodic schedule updates will be submitted by the Contractor following progress meetings with the RE and other members of the Construction Management Team.

3.1.1.3 Site-specific Construction Health and Safety Plan

In accordance with Section 01860—Safety Management, the Contractor will prepare a site-specific Construction HASP describing the health and safety requirements for the job site activities, and the measures and procedures to be employed for protection of onsite personnel. The plan will cover the controls, work practices, personal protective equipment, decontamination procedures for personnel, equipment and materials, and other health and safety requirements that will be implemented by the Contractor during the removal action construction activities.

3.1.1.4 Traffic Control Plan

The traffic control plan will describe protection and control of pedestrian and vehicle traffic during construction operations, parking for onsite workers, and haul route needs. The plan will address any traffic control issues on nearby rights-of-way (e.g., if temporary lane closures or traffic flaggers are needed for trucks entering and leaving the site), onsite traffic control measures, and any special provisions related to time restrictions on the use of haul route roadways such as when children are entering/leaving schools. The plan will follow the requirements of Section 01570.

3.1.1.5 Pollution Prevention Plan

In accordance with Section 01410, this plan will describe the environmental protection measures and monitoring activities that will accompany all construction activities. It will describe monitoring and corrective actions related to potential spills as a result of the construction operations. The plan will address spill prevention, containment, and cleanup; and water quality monitoring.

3.1.1.6 Erosion and Sedimentation Control Plan

In accordance with Section 02270, the Contractor’s Erosion and Sedimentation Control Plan will describe the temporary erosion and sedimentation control (TESC) measures to be used during all aspects of the work. It will describe the Contractor’s plan for installing, maintaining, and inspecting all stormwater and erosion control structures/activities, including silt fences, berms, catch basin protection, and grading. The TESC must be
designed and operated by a CESCL. It will include a Stormwater Pollution Prevention Plan (SWPPP).

3.1.1.7  Green and Sustainable Remediation Plan

The RAWP will describe the Contractor’s approach to GSR methods and metrics. The approach should be aimed at promoting sustainable technologies and practices for implementing the cleanup. The GSR Plan will include a description of all of the GSR elements in the Contractor’s approach including methods for emission reduction controls and use of local materials. The plan will also describe the methods for documenting the use of GSR practices and for quantifying reductions in emissions, resource use, and waste generation.

3.1.1.8  Construction Quality Control Plan

In accordance with Section 01451 – Quality Control; Laboratory Testing Services, the CQCP will present the system through which the Contractor ensures that construction activities are being implemented in compliance with the requirements of the contract. This plan will identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the QC system. Specifically, this plan will include a description of procedures for maintaining and updating activity logs; procedures for reporting emergencies or out-of-specification conditions; record-keeping procedures for personnel, equipment, maintenance, and calibration; and daily and monthly reporting requirements.

This plan also includes the Contractor’s QAPP for any analytical testing to be conducted by the Contractor, including analysis of:

- Imported backfill materials
- Waste materials (as required by the landfill)
- Treated stormwater, groundwater, wastewater, and dewatering liquids (as required in the WQC for discharge to the LDW or as required prior to shipment to an off-site commercial facility)
- LDW water samples collected at the compliance zone boundary during in-water activities; will be based on the WQMP and associated QAPP.

3.1.1.9  Transportation and Disposal Plan

This plan, in accordance with Section 02111, will address the handling, storage, transportation, and disposal of non-hazardous and hazardous wastes excavated from the site. The plan will comply with regulations administered by EPA, the U.S. Department of Transportation (DOT), and Ecology. The Transportation and Disposal Plan will describe the types and quantities of each waste stream, the transloading and disposal facilities for each waste stream, subcontractors, transportation methods, and equipment. The plan will also describe all haul routes, estimated hours and days of operation, and estimated number of trucks traveling to and from T-117 each day. All proposed transloading, recycling, and disposal facilities are subject to EPA approval and must be in compliance with EPA’s Off-Site Rule.
3.1.1.10 Survey Plan

The Survey Plan, per Section 01722, will describe the methods to perform hydrographic and topographic surveying as a way of accurately monitoring dredging, excavation, and backfilling activities. The plan will provide the name and qualifications of the independent surveyor and the Contractor’s survey crew, the equipment and methods to be used, and the schedule and format for survey-related submittals.

3.1.1.11 Excavation Support System Plan

In accordance with Section 02217, the Excavation Support Plan will describe the design, materials, and installation of all necessary controls required for stability of the excavation and to protect adjacent roadways and structures. The Contractor will locate and protect any neighboring property utilities and structures, as well as the temporary anchor for a utility guy wire located in the Upland Area. The plan will include the requirements listed in Section 02340 – Earthwork Instrumentation and Monitoring. This section describes the Contractor’s requirements for monitoring settlement points within the earthwork and on/around nearby structures. The Contractor will document through measurements and photography the existing conditions of nearby structures and roadways prior to earthwork, to serve as a baseline for comparison to observations made during and after construction.

3.1.1.12 Construction Water Management Plan

In accordance with Section 02245, the Construction Water Management Plan will describe the Contractor-designed system to collect, treat and, and discharge contaminated contact water including stormwater, soil stockpile drainage (which includes water that drains from wet excavated soil and bank sediment as well as any stormwater captured in the stockpile area), groundwater, and stormwater collected during dewatering, and other operations. Stormwater that contacts site pavement after building demolition or ground-breaking activities have begun will also be collected and treated. Contaminated soil stockpiles will be covered, to the extent practicable, to prevent rainwater from landing on them. However, the stockpile areas will require containment and all associated water will be handled in accordance with the SWPPP. The Contractor will design, install, operate, and monitor the construction water treatment system, so as to meet all discharge requirements and conditions identified in the QAPP (Attachment A) and in the EPA-provided WQC. The Contractor also has the option to collect all contact water and non-contact stormwater and transport it to a treatment facility.

The City will place a temporary overland pipe for discharge from its stormwater holding tanks during high flow events. This water is managed under the City’s NPDES permit and will discharge directly to the LDW. Since the water is not part of this construction contract, it is not included in this plan.

3.1.1.13 Settlement Monitoring Plan

In accordance with Section 02340, the Settlement Monitoring Plan will be developed by the Contractor’s Shoring Design Engineer. It will include locations, types, and details (casings,
covers, etc.) of monitoring points. The schedule for installation and baseline monitoring will also be included.

3.1.1.14 Dewatering Plan

In accordance with Section 02525, the Dewatering Plan will describe the Contractor’s approach for designing, furnishing, installing, maintaining, operating, and decommissioning a temporary dewatering system(s) and controls as required to control groundwater levels and subsurface uplifting hydrostatic pressures during construction. This plan is specific to intercepting groundwater, including water influenced by tidal cycles, from soil excavation areas to provide stable conditions for excavation. The design identified areas requiring dewatering based on design excavation grades. Soil excavations extended to below the groundwater table because of cleanup passes will also require dewatering. Other dewatering activities, such as gravity drainage of wet soil and dewatering of sediment are discussed in the Soil Stockpile Plan (Section 3.1.1.17) and in the Dredging Plan (Section 3.1.18), respectively.

3.1.1.15 Earthwork Plan

In accordance with Section 02300, the Earthwork Plan will describe land-based excavation of Upland Area and bank soil and sediment to a bottom elevation of +2 ft MLLW, including removal of debris and piles, and handling and stockpiling of all upland soil and debris. The sequencing of bank excavation, the sloping of the materials left at the bottom of the bank (to later be dredged), and the methods to ensure that all work is completed at least 2 vertical feet above the tide level, will also be included. The method of loading soil and debris into trucks and transporting these materials to a transloading facility will also be discussed.

The Earthwork Plan also describes backfilling of the site, including material selection and placement methods for fill and riprap along the bank. Specific materials to be used and compaction of these materials to achieve site stability is also discussed.

3.1.1.16 Soil Stockpile Plan

In accordance with Section 02114, the Soil Stockpile Plan will include locations and dimensions of temporary stockpile areas for excavated soil, construction details of the stockpile cells, and plans for segregating TSCA and non-TSCA impacted soil. It will also provide detail on the truck loading and empty truck staging areas. Requirements for protecting stockpiles from contact with rainwater and erosion will also be discussed. The use of berms to collect stockpile drainage water will also be included in this plan. This water will either be treated onsite (by a temporary water treatment system) or be trucked to a treatment facility. The specifications call for covering of soil stockpiles that are not actively used and for preventing stormwater runoff from leaving the stockpile areas. All stormwater will be contained and treated with stockpile drainage water.
3.1.1.17 Dredging Plan

The Dredging Plan will specify the construction approaches to dredging of sediment and maintaining close depth tolerances (to the elevations in the drawings or up to 1 ft below) on the excavation depths and volumes. Dredge and disposal includes barge dewatering and transloading of all sediment and debris from the barge to an upland handling facility. Specification Section 02325 – Dredging also discusses pile, debris, and debris deflector removal and backfilling.

The object of this dredging is to remove all contaminated sediments and a minimal volume of underlying and adjacent clean sediment, thereby creating a final surface below removal action levels (RvALs). This must be accomplished in such a manner that cross contamination among portions of the Sediment Area does not occur, and such that water quality criteria in the WQC are met. Sediment to be dredged (and any water remaining in the barge after dewatering) is to be hauled by barge to a transloading site that has been approved by EPA where they will be offloaded and placed onto appropriate transport for subsequent disposal at an EPA-approved facility. The plan will discuss all labor and equipment necessary to dredge transload, transport, and dispose of contaminated sediment in the LDW below an existing elevation of +2 ft MLLW down to the proposed post-dredge elevations of -2 to -13 ft MLLW plus any cleanup passes. Existing sediment above +2 ft MLLW will be excavated using long-reach land-based equipment, as discussed in the Earthwork Plan. Dredging will begin on the land-ward side of the dredge prism at the point where the upland bank removal efforts end so that the result is a continuous removal surface that removes all of the impacted T-117 sediment and soil.

After completion of sediment removal by dredging, the dredged area will be covered with clean sand to sandy gravel equivalent to the volume and type described on Drawing C026 and in Section 02325. This plan will discuss the physical and chemical qualities required for the backfill material.

3.1.1.18 Demolition Plan

The Demolition Plan will be prepared in accordance with Section 02220. Activities will include the demolition of site buildings; removal of asphalt, concrete, bank rip rap, piles, and debris; and transportation and disposal of these items. The plan will describe the methods and equipment to be used, protection of adjacent Marina structures, access requirements, sequencing, and handling of the materials in preparation for transportation and disposal.

This work includes Upland and Sediment Area demolition. The Upland Area work includes the requirements for the removal and disposal of all asphalt pavement, asphalitic concrete, concrete surface and subsurface features, utilities, fences, curbs, other subsurface features including USTs and scrap metal debris, debris within the bank including buried and semi-exposed roofing materials, scrap metal, concrete and brick debris, and other scrap material. The Sediment Area demolition work includes the entire removal of the debris
deflector, located immediately upstream of the Marina (21 piles), and removal of up to 10 piles and temporary anchoring or storage of Marina floats.

3.1.1.19 Deconstruction Plan

As discussed in Section 02227 – Deconstruction, the three buildings will be dismantled such that reusable and recyclable materials are segregated from material to be disposed of in a landfill. The Port has included goals in the specification for the Contractor to achieve minimum percentages of reuse and recycling of the building materials in order to divert waste from the landfill.

3.1.1.20 Vessel Management Plan

The Vessel Management Plan (Section 02325) will describe the methods for controlling vessel traffic during the work. The plan will also document the proposed vessels, navigation routes, mooring areas, timing and frequency of vessel traffic, and coordination of activities with other LDW vessels, including Tribal vessels, recreational watercraft, and vessels involved in other remediation activities. It will also discuss verification of the seaworthiness of each vessel used and specific considerations for working close to the Navigation Channel, including buoys to direct LDW traffic and precautions to prevent impacts to the LDW community. Considerations for working in close proximity to the Marina will also be discussed. No coordination is anticipated with South Park Bridge construction vessels because this construction is to be completed prior to T-117 in-water activities; however, if bridge construction is delayed, the Vessel Management Plan will be modified accordingly.

3.1.1.21 Sheet Pile Driving Plan

The Sheet Pile Driving Plan (Section 02454) will describe the Contractor’s approach for installing steel sheet pile wall to isolate the middle portion of the bank from the LDW. This plan will describe the equipment to be used, the piling to be purchased, the staging of the piling on the Upland, the methods for installing the piling with a vibratory hammer, the manner of dealing with obstructions, the use of sealant in the joints, and the use of block nets to prevent fish from getting stranded behind the wall at low tide.

3.1.1.22 Final Water Quality Monitoring Plan

The Design Team has written a draft WQMP describing the proposed approach for monitoring the quality of LDW water during in-water activities, such as dredging. This approach was developed through EPA review of drafts of the plan and through meetings with EPA. The plan describes field monitoring for turbidity, dissolved oxygen, pH, and temperature, as well as the collection of water samples for laboratory analysis of sediment COCs. The Contractor will prepare a final WQMP (01400), as a part of the RAWP, using the Contractor’s specific plans for the completing the work, e.g., Dredging Plan. However, the frequency of monitoring, criteria, analytes, and corrective actions will be the same in the Final WQMP as in the draft version. EPA will issue a WQC which will also describe the requirements for in-water monitoring, including monitoring frequency, analytes, criteria,
corrective actions, and reporting. The WQC is the binding document by which the Contractor’s monitoring program must abide.

3.1.1.23 Construction Checklist

The Contractor will develop and submit a Construction Checklist (Section 01400) based on requirements of the contract documents. It will list items that should be in place and operational prior to the start of any ground breaking activities. The Construction Checklist will focus on required site controls and health and safety requirements necessary to begin work. It will be utilized to track all items to be completed before construction begins.

3.1.1.24 Contractor’s Daily Construction Report Form

The Contractor will prepare a form that will be used to transmit the Daily Construction Report. The form will be submitted in the RAWP to be approved by the Port. The form will be used to transmit information/data pertinent to the specific activities performed each day, e.g. surveying, water quality monitoring. The Port will use the Daily Construction Report to prepare Weekly Quality Assurance Reports to EPA.

3.1.2 Final RAWP

According to the schedule in the Removal Design Report, EPA will review the draft RAWP by March 2013. The RAWP will be modified per EPA comments, and a final RAWP will be submitted to EPA in April 2013. Upon EPA approval of the final RAWP, EPA will issue a notice to proceed for initiation of construction activities in May/June 2013.

3.2 Construction Documentation

During construction activities, the Contractor will be required to submit daily reports to the Port RE. These submittals are for informational purposes only and are intended to summarize daily work conditions, deviations, and corrective measures. The Port will use information in these reports to prepare weekly reports for EPA. Additional documentation required by the Contractor for specific construction elements are discussed in Section 4. The specifications also describe Contractor submittal requirements in detail. Beyond these standard reporting requirements, EPA will be notified immediately (per HASP) of any emergencies (including injury, accidents).

3.2.1 Contractor’s Daily Construction Report

In accordance with Section 01400 – RAWP, during construction activities, the Contractor will prepare a Daily Construction Report and submit it to the RE. The reports will summarize the work performed by the Contractor, the equipment used, and the results of any QC inspections, tests, or other monitoring activities, such as water quality monitoring or treated water discharge monitoring. The reports will also document any noncompliant conditions, communication of such conditions to the RE, and correction actions taken to attain compliance.
During excavation and dredging activities, the Daily Construction Reports will also include a Daily Excavation or Dredging and Disposal Report, as applicable, detailing removal and disposal operations and tabulating materials removed. Similarly, the Daily Construction Reports will include a Daily Backfilling Report whenever materials are being placed. Weekly summaries of activities will also be included, as appropriate, on Daily Construction Reports. The weekly reports will be paraphrased and shared with the community through the various media/communication outlets described in the CHASP.

According to Section 02454, during sheet pile wall installation, records of the sheet piling driving operations will be submitted each day after driving is completed. These records will provide a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions, and top and bottom elevations of installed piling. A sample sheet pile driving record will be submitted to the RE for approval, prior to the start of pile driving.

3.2.2 Weekly Quality Assurance Report

The Port will prepare a QA Report on a weekly basis and submit it to EPA in electronic format. The QA Report will include a detailed description of construction events, as well as any delays and their causes. The report will describe the results of QA inspections, testing, surveying, any monitoring activities, and the effectiveness of the Contractor’s QC activities. The Contractor’s Daily Construction Reports will be included with the QA Report, as either scanned hand-written notes or in some other electronic format. The QA Report will also include information about the water quality monitoring, treatment plant discharge, the air, noise, and light monitoring undertaken to protect community health and to address community concerns, any confirmation sampling conducted, and any other sampling/monitoring completed.

If Port QA inspections reveal out-of-specification conditions, the RE will immediately contact the Contractor PM and/or the CS to determine what action(s) will be taken to modify the construction operations and to correct the condition. If the correction requires a major change in the design or construction process, the initial contact will be followed up with a written memorandum to the CS confirming any oral instruction given. Instructions to the Contractor for any work that deviates from the specifications will be given in writing. The results of the discussions and follow-up corrective actions will be included in the Weekly QA Report.

Specific measures for addressing exceedances of water quality and treated water discharge performance standards are discussed in Sections 3.2.3, and 3.2.6, respectively.

The Contractor, RE, DL, and potentially other members of the Construction Management Team will meet weekly with the ACOM to review the Weekly QA Report and to keep the EPA informed of continuing events as the construction proceeds. Any changes to EPA-approved documents will be approved by EPA before being implemented.
In the event that a change or changed condition is encountered, as defined in the contract documents, the Contractor, the RE, and the DL will review the condition and jointly determine what revision in the construction activity or construction product will be required, consistent with the intent of the design documents. All changes will be communicated to EPA, and EPA will be involved in the review and revision if the change is significant in its impact. The weekly meeting is the proposed forum to discuss any changes in construction activities or construction products.

3.2.3 Water Quality Monitoring Summaries

Water quality data will be generated by the Contractor in accordance with the WQMP and requirements of EPA’s WQC and the WQMP.

The Contractor will be required to modify operations as needed to comply with the requirements of the WQC. The Contractor PM is ultimately responsible for ensuring that construction operations are in compliance with the WQC. The Port RE may direct the Contractor to stop work if out of compliance. The WQMP describes the sampling protocols and performance standards.

Any corrective actions will be reported immediately to EPA. All field and analytical monitoring data will be provided electronically to EPA with the Weekly QA Report. At the completion of construction activities, a discussion of the monitoring activities will be included in the Removal Action Construction Report.

3.2.4 Air, Noise, and Light Monitoring Summaries

Air quality, noise, and light data will be generated by the Construction Management Team in compliance with the CHASP. The monitoring plan (an attachment to the CHASP) documents the sampling protocol, sampling locations, sampling frequency, action levels, and notification procedures.

Any corrective actions made by the Contractor (at the direction of the Port RE) will be reported immediately to EPA by the Port. Periodic reports to the public will be prepared by the Port and disseminated using the communication methods described in the CHASP. All field and analytical monitoring data will be presented in the Weekly QA Report to EPA. At the completion of the project the data will be provided electronically to EPA and will be summarized in the Removal Action Construction Report.

3.2.5 Hydrographic and Topographic Survey Reporting

Pre- and post-hydrographic and topographic surveys (acceptance surveys) that are used for payment and acceptance of the work will be completed by an independent professional surveyor under contract to the Contractor. The Contractor will complete daily progress surveys. Progress and acceptance surveys will be reported to the Port in the Daily Construction Reports, and to EPA in the Weekly QA Reports. Drawings, field notes, and quantity computations will be submitted within seven calendar days after completion of
each survey. The survey data, along with the soil and sediment quality analytical data, will be used to confirm completion of excavation. The final excavation and backfill survey data will be provided for review in the Pre-final Inspections and will be included in the Removal Action Construction Report.

### 3.2.6 Waste Characterization Testing Reports and Manifests

The Contractor will submit Waste Characterization Testing Reports documenting chemical analysis of:

- Treated water, discharged to the LDW, that was collected from dewatered excavations, stockpiles, and stormwater BMPs, as required by the substantive National Pollutant Discharge Elimination System (NPDES) permit requirements or other relevant discharge criteria, if contact water is treated onsite and discharged to the LDW.
- Any waste materials for which EPA requires additional characterization prior to disposal or recycling. Existing soil and sediment chemistry data will be submitted to the landfill operators to verify the nature of material transported to the landfills.

Treated water discharge sampling frequency, parameters, and compliance criteria are described in the QAPP (Attachment A). The Contractor also has the option to collect all contact water and transport it to a treatment facility. Chemical testing will be completed by the Contractor using accredited laboratories. All characterization will be in accordance with the requirements of Section 01451—Quality Control; Laboratory Testing Services and Section 02245 – Construction Water Management System.

The Contractor will submit for review all transportation-related shipping documents in accordance with Section 02111—Waste Material Disposal, including draft manifests for waste; draft bills of lading; lists of proposed labels, packages, markings, and placards to be used for shipment; and any waste profiles and/or supporting waste analysis documents a minimum of 7 days prior to anticipated shipment. Generator copies of manifests used for initiating shipments of waste, bills of lading, and supporting waste analysis documents will be furnished when shipments are originated. The Contractor will not allow any waste to leave T-117 until shipping documents have been approved by the Port RE, and the receiving facility is approved by EPA under the Off-Site Rule. Receipt copies of waste shipment records at the designated disposal facility will be furnished no later than 35 days after acceptance of the shipment.

If the sediment transloading facility is receiving contaminated sediment from multiple ongoing projects, the Contractor must submit reports specifically documenting quantities/masses of sediment received from T-117. The volume of sediment, water, and debris disposed of is determined by a barge displacement inspector who documents barge depth in the LDW prior to and following sediment unloading. The difference in barge displacement before and after unloading is then converted to a mass or volume of sediment.
Material sent for recycling (e.g., concrete slabs, metal debris) must meet any requirements specified by EPA and must be visually free of any soil or sediment. Any analytical data relating to these items will be provided to the recycling facility to document that only clean materials are being transported for recycling. Debris to be recycled must meet the Land Disposal Restrictions in 40 Code of Federal Regulations (CFR) 268.45, and the recycling facility must be approved by EPA under the Off-Site Rule.

### 3.2.7 Import Material Characterization Reports

The Contractor will submit a Pre-Construction Testing Report for chemical and physical analysis of import materials no later than 14 calendar days prior to the commencement of material placement for acceptance by the Port and EPA. The report will identify the origin of the materials. Chemical and physical testing, discussed in Sections 4.9 and 4.10 of this CQAP, will be completed by the Contractor or the material suppliers, in accordance with the Section 01452 and the approved Contractor’s SAP, using accredited EPA-approved laboratories.

Materials will be analyzed according to the frequencies in specification Section 02300 - Earthwork, which specifies one gradation and one chemical sample of any one source and type of import material. If the source of the material changes, an additional sample (analyzed for both gradation and chemistry) will be required.

All characterization will be in accordance with the requirements of specification Sections 02300 and 02325 - Dredging and with the chemical quality criteria in Sections 4.9 and 4.10 of this CQAP. No material will be brought onsite or placed in the water until EPA has approved the test results.

### 3.2.8 Field Change Documentation

In the event that a changed condition, or activity from that documented in the contract documents, is encountered by the Contractor, the Contractor PM, the CS, and the Port RE will review the condition and jointly make a determination regarding the revision such that it is consistent with the intent of the design documents and that it sufficiently addresses the changed condition. EPA will be notified of any field changes, either immediately or in the Weekly QA Report (depending on the magnitude/nature of the change). EPA will review to ensure that the change does not compromise the achievement of the cleanup objectives or protection of human health and the environment. In addition, the EPA will evaluate conformance with performance standards, ARARs, and the SOW. This process will be documented on a Field Change Request Form.

Field changes may occur as a result of weather conditions, an accident or emergency, analytical results, or other conditions encountered in the field. Field changes can also occur in response to community concerns/safety or discoveries of methods to increase efficiency while in the field.
3.3 Post-Construction Documentation

The following will be required upon completion of construction.

3.3.1 Record Drawings, Manuals, and Certifications

The Contractor will be required to submit record drawings for various elements of the construction, including the building demolition, pile and debris deflector removal, and dredging/excavation/backfilling surveys. The Contractor will also submit certificates of conformance for import materials, including backfill soil, riprap, and pilings installed to support the Marina floats and debris deflector. The Contractor will submit these materials to the Port, and they will be included in the Removal Action Construction Report submitted to EPA.

Following excavation completion of each distinct area: Sediment Area, Upland Area soils, and riverbank sediment/soil, a Pre-Final Construction Completion Report will be prepared by the Port. It will describe the confirmation sampling data (including any relevant statistics), any additional excavation passes (excavation completion decisions made using those data), the post-excavation topography/bathymetry data, and any deviations from the sampling plan.

According to the SOW, the Port will submit the following post-construction documents to EPA using information from the Contractor and Port-generated data/information (such as excavation confirmation soil data):

- Final Construction Letter/Reports – within 30 days following final construction inspection/meeting
- Removal Action Construction Report – within 30 days following pre-certification inspection
- Removal Action Completion Report – within 30 days after removal action objectives have been obtained, i.e., post-excavation data meet RvALs.

3.3.2 Pre-Final Inspection and Punch List

Following the pre-final inspection of the completed work with the Port and the EPA, the Contractor will assist the RE and DL in preparation of a consolidated list of items (i.e., the pre-final punch list) to be completed or corrected after inspection. The Contractor may also be asked to assist the RE and DL in the preparation of the pre-final inspection reports.

3.3.3 Final Inspection Report

After all items on the pre-final punch list are completed, the Contractor may assist the RE and DL in the preparation of a final inspection report. This will follow a final inspection and meeting with the ACOM.
4 Removal Action Construction Elements

Depending upon the specific activity, the Contractor, RE, DL, QAO, other members of the Construction Management Team, and EPA will conduct inspections, sampling/testing, and monitoring activities to ensure compliance with the terms and conditions of the contract. The Construction Management Team (Port RE, DL, and consultant QAO) will monitor the Contractor’s QC activities to verify compliance with the contract requirements, the CQCP, and this CQAP. Documentation of these activities is discussed in this section, and will be provided to EPA in the Weekly QA Reports.

4.1 Summary of Inspection and Monitoring Tasks

Inspection and monitoring activities are organized by the following Phase 1 areas. These activities are to be conducted by the Contractor\(^2\), unless specified otherwise. Table 4-1 summarizes the construction elements and their monitoring activities.

**Sediment Area**

- Monitoring of water quality at the compliance zone boundary in accordance with the WQMP and WQC, issued specifically for this project during all in-water construction activities. The Contractor will also observe the dredging and debris removal activities (at the point of the activity) for releases of oils, sheen, or other materials.
- Verification of the quality and thickness of the sheet piles to be used to isolate the middle portion of the bank and verify the joint sealant used in wall seams, to be conducted by the DL
- Installation of the sheet pile wall will be observed by the DL and/or its subconsultant, and any need for an impact hammer to drive through debris (or excavation to remove debris) will be carefully considered or timed to correspond to low tides. Water quality monitoring, as described in the WQMP, will be conducted to confirm that water quality is not adversely impacted by this activity.
- Verification that access to the Marina by mariners is not restricted during the work
- Verification of the quality and thickness of replacement pilings installed in and upstream of the Marina following dredging and backfill. These replacement pilings will hold the floats and the debris deflector after they are returned to their original locations. This includes verification that the floats are returned to the correct location and alignment, and that meet appropriate codes related to utilities and in-water habitat. This will be conducted by the DL.

\(^2\) Responsibility by the “Contractor” includes subcontractors, in addition to the prime construction contractor. The quality of any work completed by subcontractors is the Contractor’s responsibility. EPA and appropriate resource agencies will also oversee these tasks and related documentation/plans. Documentation of these tasks may be shared with the community per the Community Involvement Plan and the CHASP.
• QC checks on the location of the dredge prism (stationing, offset, and elevation); this may be done through Port surveys by or verification/review of the Contractor’s survey data by the Port.

• Verification that all pilings and debris are removed prior to dredging and bank excavation

• Visual verification that Ecology blocks, filter fabric, and other sediment control structures on barges are retaining sediment and allowing only water that passes through the filter fabric to drain back into the LDW

• Verification that barges are being allowed to passively dewater for a minimum of 8 hours before they are moved to the transload facility for offloading

• Inspection verifying that operations at transloading facility are in compliance with EPA’s Off-Site Rule. Inspection also verifies weights of sediment received/handled, using barge displacement.

**Bank Excavation**

• Verification that bank excavations are only conducted with a 2-ft elevation or 6-ft horizontal separation between tide level and excavation activities

• Comparison of predicted tide levels to actual tide levels to plan tide-based work activities

• Verification that bank excavations are back-bladed and covered with filter fabric following each low tide such that soil will not erode upon tidal inundation and fish will not become entrapped in bank pockets

• Inspection of sheet pile wall during excavation of the middle portion of the bank to document that bank materials are not reaching the LDW. The barrier will also be observed to determine that the wall is performing as designed and to ensure its stability.

• QC checks on erosion control features to document that they are performing as designed.

**Upland Area**

• Confirmation that all TSCA-level soil have been removed (per topographic survey), loaded, transported, and disposed of in accordance with the TSCA requirements

• Confirmation that the heating oil UST under the North Building is properly decommissioned, and that any impacted surrounding soil is removed

• Confirmation that the previously-unsampled soil under the North Building is sufficiently characterized, and that any necessary soil excavation is completed to the appropriate elevations (Port Consultant; Attachment A)

• Characterization sampling of treated water from upland operations prior to discharge to the LDW, if onsite treatment is used for contact water and
stormwater. Contaminated contact water and non-contact stormwater may be treated in an upland water treatment system (temporarily constructed onsite for this NTCRA) or may be transported to an offsite facility for treatment. Contact water includes groundwater pumped from deep excavations and from within the sheet pile wall enclosure, stormwater in contact with contaminated soil, decontamination fluids, and soil stockpile drainage. Non-contact stormwater generated from site pavement after either building demolition or site-disturbing activities have begun will be collected and handled with contact water.

- Verification that any historical backfill materials (e.g., from 2006 time-critical removal action) are suitable for reuse.
- Verification that designated structures and debris have been properly removed and disposed of or recycled in accordance with EPA’s Off-Site Rule
- QC checks that stormwater and erosion control BMPs have been implemented and maintained in the Upland Area. This includes areas where soil/sediment is actively excavated and where they are stockpiled for loading onto trucks leaving the site.
- Compaction testing to verify that backfilled soil is placed in the correct manner to allow structural integrity
- Effectiveness of shoring through monitoring of adjacent structures, utility pole(s), and roadway, per specification Section 02340 – Earthwork Instrumentation and Monitoring.

**Multiple Areas**

- Confirmation sampling of the bottom of soil and sediment excavations for compliance with the RvALs listed in Table 4-2. This will be performed by the collection of composite soil and bank sediment samples and of single sediment sample according to the QAPP (Port or Consultant; Attachment A).
- Verification that equipment and trucks leaving the site with Upland and bank soil are properly decontaminated (wheel wash and dry brushing), lined (if necessary), and covered, and that no dust leaves any truck and no soil is tracked out as the truck travels through the community
- Review of horizontal and vertical control survey procedures for dredging, backfilling, and bathymetric and land surveying (third-party surveyor)
- Verification that imported sediment and soil backfill materials comply with contract requirements for quality, durability, grain size, and chemical quality prior to delivery to T-117
- Verification that debris to be recycled, e.g., concrete slabs and metal debris, is clean and free of contamination prior to transport to the recycling facility
- Verification of placed backfill (and bank riprap) thicknesses, limits, and extents (third-party surveyor).
The Contractor’s work will be conducted in accordance with the contract drawings and specifications, including implementation of QA/QC procedures specified therein, as necessary to complete a successful remediation. A narrative of the work and QA/QC procedures to be completed by the Contractor will be presented in the CQCP. This section describes several work items for which the Contractor has primary responsibility using the following general outline for each work item:

- Task Description—Brief description of the removal action task, the equipment, and general procedures that will be utilized to accomplish the activity. Note that this is not intended to be a detailed breakdown of the task.
- QC Measures—Measurements, procedures, or inspections to verify compliance with drawings and specifications and anticipated remedies to correct QC deviations.
- Environmental Controls, Monitoring, and Corrective Actions—Environmental monitoring tasks to be performed during removal construction activities, required field and/or laboratory tests and analysis, monitoring schedules and durations, and environmental compliance criteria and corrective actions to be implemented in the event of non-compliance. All data and resulting corrective actions will be documented, as described above.

### 4.2 Survey Controls and Project Limits

#### 4.2.1 Description

The Contractor will employ an independent licensed surveyor to perform hydrographic and topographic surveys for the following:

- Pre-Construction Baseline—to establish the layout of work and baseline conditions
- Final Dredging and Excavation Acceptance—to obtain data for final dredge and excavation volume calculations and to verify that final dredged grades and excavation grades are acceptable, to identify when confirmation sampling can occur or backfilling can begin.
- Final Backfill Acceptance—to verify that final grades and backfill thicknesses are acceptable
- Record Document Survey—to document all final conditions after any required corrective actions.

Progress hydrographic surveys will be performed by the Contractor as a way of accurately monitoring dredging activities. Topographic surveys will be performed to tie in the hydrographic survey to the top of the slope and provide verification of hydrographic survey data. All hydrographic and topographic surveys will be conducted in accordance with specification Section 01722 - Surveying.
4.2.2 Quality Control Measures

All topographic survey, layout, and related work will be performed and signed by a professional land surveyor registered in the state of Washington. All hydrographic surveying will be performed by a surveyor who will have been actively engaged in hydrographic survey operations during the past four years, and all surveys will be performed in accordance with the standards given in USACE Engineering Manual 1110-2-1003.

4.2.3 Environmental Controls, Monitoring, and Corrective Action

The Port will provide QC of the Contractor surveys by reviewing all topographic data generated by the Contractor. The Port reserves the right to retain an independent surveyor (or use a Port surveyor) to periodically conduct independent surveys, if deemed necessary, at the discretion of the Port. The Contractor will protect survey control points prior to starting site work and preserve Port-established Upland reference points (benchmarks) during construction. The Contractor will establish any needed benchmarks, as described in specification Section 02325 – Dredging.

The Contractor will not relocate site reference points without prior written approval from the Port RE. The Contractor will promptly report to the Port the loss, damage, or destruction of any reference point or relocation required because of changes in grades or other reasons. The Contractor will replace dislocated survey control points based on original survey control at no additional cost to the Port. Replacement of dislocated survey control points will be done by a Professional Land Surveyor licensed in the state of Washington.

Hydrographic survey procedures (positioning modes, electronic positioning system, and/or global positioning system) calibration, data reduction, adjustment, processing, and plotting will conform to industry standards. Horizontal location observations will compensate for errors, geodetic corrections, and atmospheric variations.

Data recording, annotation, and processing procedures will be consistent with recognized hydrographic survey standards. Failure to perform and process such surveys in accordance with recognized standards will result in a rejection of the survey results.

4.3 Installation of Sheet Pile Wall

4.3.1 Description

The middle portion of the bank is to be excavated to a bottom elevation of 0 ft MLLW inside the wall (and dredged to -2 ft MLLW outside the wall), while the northern and southern portions will be excavated to +2 ft MLLW when tides are low. To protect the deeper middle bank excavation from tidal inundation and to extend the excavation period beyond low tide times, a sheet pile wall will be installed in the LDW and tied back into the Upland Area. In summer 2013, the sheet pile wall will be installed parallel to the bank along
the +2 ft MLLW bathymetric contour, with return side walls extending into the Upland Area. Sheet pile wall removal will not occur as part of this NTCRA.

Section 02454 describes the considerations for sheet pile wall installation, including the driving of all sheet piling (including special piling required for closures and corners) with a vibratory hammer (unless obstructions are encountered), staging of sheet pile, and excavation, removal, and disposal of all materials and obstructions encountered that interfere with the driving of the barrier within the top 10 feet of the installation.

4.3.2 Quality Control Measures

Sheet pile wall installation is to occur with a vibratory hammer, unless debris that cannot be penetrated is encountered. In those instances, the debris will either be removed, the affected sheet piles will be left above the final design depth (if it is determined that this approach will not adversely impact the function of the wall), or an impact hammer will be used to drive through debris. Removal of debris or driving with an impact hammer will only occur at a low tide when the bottom of the wall is exposed above the tide level, to limit sound propagation and turbidity generation in the adjacent LDW.

These BMPs/considerations, and their expected effectiveness at protecting threatened and endangered fish species, is documented in the ESA Section 7 Biological Assessment.

New sheet piling and appurtenant materials will be certified by the manufacturer to meet the specified material and section property requirements. If used sheet piles are proposed by the Contractor, the Contractor will be responsible for providing certification that they meet the material and section properties specified in Section 02454 – Sheet Piling prior to delivery to the site. Prior to installation, the sheet pile will be inspected by the Construction Management Team and the Contractor to demonstrate that they meet the requirements in Section 02454. Used sheet piles will be inspected for interlock soundness, and any questionable interlocks (bent/damaged/loose) will be cause for rejection of the entire sheet pile. The sheet pile sealant will be documented to be as specified in Section 0454, and application of the sealant will be as required in the manufacturer’s recommendations. After installation and following any potential in-water disturbance (such as high-flow conditions), the wall will be inspected to document that it is functioning as designed.

4.3.3 Environmental Controls, Monitoring, and Corrective Action

The Contractor, RE, and DL will each inspect various components of the sheet pile wall installation and performance. Whether new or re-used, only materials that meet the manufacturer’s QA tests may be delivered to the site. According to Section 02454 the Contractor will handle the sheet pile in a manner recommended by the manufacturer to prevent permanent deflection, distortion, or damage to the interlocks. Any damage that does occur will be drawn to the attention of the RE, and the Contractor will submit his proposal for corrective action for approval by the RE prior to commencement. Piling that is damaged during handling will be repaired or replaced at the Contractor’s expense.
The sheet pile sealant will be installed by the Contractor in accordance with the manufacturer’s recommendations. The sheet piles will be handled such that the integrity of the sealant is not adversely affected prior to pile installation.

Piling will be installed by the Contractor with a vibratory hammer of the correct size and by methods approved by the RE so as not to subject the piling to damage and to maintain proper interlocking. The Contractor, RE, and DL will inspect the interlocked joints of sheet pilings extending above the sediment mudline. Pilings found to be out of interlock or with leaking interlocks will be evaluated to determine if additional measures will be taken to limit seepage through the piling. During pile driving and subsequent bank excavation, any water quality exceedances will be addressed through the process in the WQMP. Block nets will be used so that fish cannot become entrained behind the sheet pile wall before the area is enclosed.

4.4 Demolition and Removal

4.4.1 Description

Demolition and removal of debris, pilings, and the debris deflector will be performed prior to dredging and soil excavation per Specification Section 02325. Structures and pilings designated for demolition or removal are shown in the drawings. Materials are to be transported to EPA-approved (per Off-Site Rule) disposal or recycling facilities.

Characterization of the debris and offsite disposal and recycling at an approved location is the Contractor’s responsibility. Any debris characterized as hazardous or dangerous waste must meet appropriate disposal requirements. Any materials to be recycled must be acceptable to the recycling facility, and the facility must be approved by the EPA as a suitable off-site facility. Trucks, rail, or barges may be used for transport of demolition debris to approved disposal and recycling facilities.

4.4.2 Quality Control Measures

Removal of approximately 90 piles (including those for the debris deflector and the Marina floats) and debris throughout the Sediment Area is necessary for bank excavation and for dredging operations. Every practicable effort will be made to extract the entire length of each pile prior to dredging. Other currently-unknown debris may need to be removed if encountered during excavation and dredging operations. Piles and debris must be removed from soil and dredged material (or broken to acceptable lengths and disposed with the soil and sediment) if required by the disposal or recycling facility. Debris removed using land-based equipment staged on the bank, will be stored in a stockpile location on the Upland Area. Debris removed with in-water equipment will be placed on barges with the sediment. Creosote treated wood may be shipped to a regulated commercial or industrial furnace or boiler to be burned for energy recovery (Ecology 2003).
The Marina owner will detach, move, and store the floats and vessels to be temporarily moved to provide dredging access. The Contractor will remove the piles and install replacement piles when the dredging and backfilling are completed.

Materials, such as concrete slabs, metal, and asphalt, removed from the Upland and Sediment Areas and sent to a recycling facility must be acceptable to the recycling facility. Cleaning may be required prior to transport offsite. EPA’s Land Disposal Restrictions (40 CFR 268.45) describe methods for ensuring that debris in contact with contaminated soil/sediments is cleaned. The Contractor will coordinate with recycling facilities and with the Port/EPA so that the debris is acceptable to the recycler and so that the facility is in accordance with EPA’s Off-Site Rule.

4.4.3 Environmental Controls, Monitoring, and Corrective Action

The RE will verify that debris and pile removal is performed at the correct locations. Potential environmental concerns include increased turbidity and releases of debris to the LDW water column during these activities. Release of some turbidity during removal of submerged piles is inevitable, and control measures for such releases will be outlined in the Contractor’s Pollution Prevention Plan and Dredging Plan.

In-water turbidity, pH, dissolved oxygen, and temperature monitoring will be conducted during in-water work at the compliance zone boundary, in accordance with the monitoring frequency defined in the WQMP and the EPA-provided WQC. Water samples will be collected for laboratory analysis if an exceedance of in-water criteria (e.g., turbidity) is measured, per the WQMP. Additionally, the Contractor must visually inspect for turbidity and sheens at the point of removal. Field exceedances or observations of turbidity/sheen will result in stopped/modified activities. Sample collection for laboratory analysis is not required during pile/debris removal, but monitoring of field parameters during at least three days of in-water work will occur.

The Contractor is responsible to perform the activities in such a way that Marina property is not damaged and that other LDW users remain clear of the work activities. If property damage occurs, the RE will be immediately notified so that the operator of the Marina can be notified and appropriate corrective actions can be performed.

4.5 Dredging and Excavation

4.5.1 Description

This element includes the dredging of contaminated sediments from the Sediment Area and excavation of bank and Upland Area soil as depicted in specification Sections 02300 and 02325 – Earthwork and Dredging, respectively. Dredged material will be loaded onto a flat-deck barge (equipped with sideboards and appropriate runoff filters for turbidity control) for dewatering onsite. The barge will be transported to a designated transloading facility after it is loaded. Dredged material will be transloaded (transferred from the barge
to shore and then to land-based transportation) at a nearby, yet to be determined, facility for eventual upland disposal.

Sediment dredging will occur in open water following debris and pile removal and temporary relocation of a portion of the Marina floats. The following subsections describe various QA/QC measures to assure completeness of the excavation and dredging activities. Figure 4-1 shows the excavation plan (design grades; each cleanup pass will extend the dredging prism 1 foot deeper than the design grades).

The bank will be excavated in three sections. The northern and southern sections will be excavated when the bank is not inundated with river water (i.e., during tidal stages such that there is a 2-ft vertical separation or a 6-ft horizontal separation between the water level and the sediment being excavated). The middle portion of the bank will be excavated to a bottom elevation of 0 ft MLLW behind/within a sheet pile wall (installed along the current +2-ft MLLW bathymetric contour) regardless of tide level.

The Upland Area soil will be excavated to the various bottom elevations shown in Figure 4-1. Some of the soil to be excavated (and some sediment that will be behind the sheet pile wall) is considered TSCA-level soil/sediment because its total PCB concentrations exceed 50 mg/kg dw. Sequencing will be determined by the Contractor and documented in the RAWP. All TSCA-level soil will be segregated from the non-TSCA level soil. Water that drains from stockpiled soil will either be treated in the Contractor-designed/operated water treatment system along with all other contaminated contact water or will be collected and transported offsite for treatment.

4.5.2 Quality Control Measures

4.5.2.1 Achieving Specified Dredging Depths, Slopes, and Limits

The Contractor will be required to perform progress hydrographic and topographic surveys and utilize appropriate positioning controls to demonstrate that contaminated soil and sediment is removed to the elevations and limits specified in the Drawings. Positioning and survey equipment will be maintained and calibrated for the life of the contract per Specification Section 01722. Procedures to demonstrate that the equipment performs to the accuracy required by the specified type of survey will be described in the CQCP.

4.5.2.2 Hydrographic and Topographic Surveys

The Contractor will employ an independent licensed surveyor to perform pre- and post-excavation/dredge and post-backfill acceptance surveys for all excavation/dredging work. These surveys will be used to establish compliance with the contract documents. The Contractor will also perform daily progress surveys and provide these to the RE. These surveys will be summarized in the Weekly QA Reports to EPA.

The survey control requirements will comply with the minimum performance standards in the specifications (Section 02325). The dredging will be positioned with a real time
The Contractor will perform post-excavation topographic surveys to verify that soil and bank removal limits are met. At the overlap of the topographic and bathymetric survey data, if there are discrepancies, the data from the topographic survey will take precedence.

The technical survey specifics described above may be superseded by detailed information in Section 01722 or in the Survey Plan contained in the RAWP.

### 4.5.2.3 Dredge Positioning Controls

The RE will work closely with the Contractor and hydrographic survey crew to independently verify the dredge’s horizontal position and dredging depth. This may be done by evaluating the Contractor’s surveys and/or positioning data and/or conducting independent surveys. If the RE determines that the Contractor is not dredging to the proper elevation or in the correct location, the RE will immediately contact the Contractor SS to correct the situation. Any such direction and corrective action will be documented in the Daily Construction Report and the Weekly QA Report.

### 4.5.2.4 Minimizing Residuals and Turbidity from In-water Activities

A number of performance requirements, sequencing requirements, and BMPs are included as design requirements in the specifications to minimize residuals and water quality impacts during in-water activities. Specific performance requirements, sequencing issues, and BMPs are summarized in Section 5 of the Removal Design Report. Specification Section 02325 describes the contract requirements.

The Contractor’s RAWP will identify additional BMPs, operational controls, and equipment options available for minimizing water quality concerns. It will also discuss potential contingencies for addressing water quality exceedances. These elements will be implemented, if necessary, to control for turbidity/water quality impacts. The WQMP describes how water quality impacts will be identified.

Operational or engineering controls may include:

- Dredging during lower tidal stages or during slack tides, as practical
- Increasing the elevation span (i.e., greater than 2 feet) between bank excavation and the LDW water level, for excavating the northern and southern bank areas
- Re-evaluating predicted tide levels relative to LDW flow conditions. Predicted tide levels are used to schedule bank excavation and other in-water activities.
However, this schedule may need to be adjusted if LDW levels are higher than predicted, e.g., a storm event has increased flow.

- Decreasing the rate of dredging; this may include decreasing the speed of the ascending or descending bucket as it moves through the water column, pausing the bucket before digging, or pausing the bucket for longer periods at the water surface to facilitate drainage.
- Modifying the positioning of barge(s)
- Modifying bucket movement to dislodge adhering material
- Stopping work
- Additional filtration BMPs for handling sediment dewatering liquid on the barge before it flows back into the LDW.

4.5.3 Environmental Controls, Monitoring, and Corrective Action

The Contractor (by hiring a qualified subcontractor) will conduct water quality monitoring during in-water activities to document water quality impacts caused by dredging or other in-water activities. Water quality will be monitored through the approach described in the WQMP for compliance with the WQC, to be issued by EPA. If the provisions of the WQC conflict with any provisions presented in this CQAP, the WQMP, or the project specifications, the WQC will take precedence.

In addition to monitoring, oil spill control measures will be implemented during all in-water activities. The Contractor will continuously visually monitor for sheens or floatable materials whether they originate from sediments, piling/debris, or the Contractor’s equipment. At the first indication of any oil sheen originating from construction activities, the Contractor will contain the sheen with appropriate sorbent and containment materials. If the sheen escapes the work area, the Contractor will cease in-water work until the problem is rectified to the satisfaction of the Port and EPA.

4.5.3.1 Achieving Toxic Substances Control Act Soil Excavation

Past soil and sediment sampling events have defined the removal boundaries in both the Upland and Sediment Areas. These sampling events have also defined the extent of TSCA-level (total PCB concentrations above 50 mg/kg dw) soil and sediment (Figure 4-1). TSCA-level soil and sediment must be segregated and handled separately from non-TSCA material. Because all soil and sediment surrounding the TSCA-excavations will also be excavated and disposed of, the TSCA-excavation prisms will not be sampled to confirm excavation completion. Existing data have been used to pre-confirm TSCA soil excavation completion.

4.5.3.2 Achieving Removal Action Levels

Compliance with the analytical criteria and other metrics (such as post-dredge surveys or depth of dredging) must be confirmed before excavation is considered complete and/or
before backfilling may begin. These subsections describe the methods by which compliance with analytical criteria is determined.

**Collection of Confirmation Samples**

EPA’s *Methods for Evaluating the Attainment of Cleanup Standards* (EPA 1989) suggests dividing a site into suitable sampling areas that are coincident with specific site activities or chemical usages (EPA 1989). Excavation completion confirmation is determined for three separate areas: 1) Upland Area, 2) riverbank, and 3) Sediment Area.

In the Upland Area, post-excavation soil samples will be collected from the bottom of each excavation grid cell to confirm that remaining soil meet removal goals. Soil excavation may proceed in stages, such that the whole site is not disturbed at one time. The sequencing of soil excavation will be determined by the Contractor and documented in the RAWP. Backfilling may not begin until the data confirm that RvALs are achieved, as described in this CQAP. However, because RvAL achievement is based on an evaluation of the entire population of post-excavation data (described below), conservative decisions may be made early in the process if certain grid cells are to be backfilled before the entire Upland excavation is complete.

Following completion of excavation of a Contractor-specified area, one soil sample will be collected from the bottom of each ~2,500-sq ft area (grid cell) shown in Figure 4-2. Each sample will be composed of three surface grabs collected from within a grid cell and composited into one sample. The grid, and thus the dataset generated with this grid, will cover the entire Upland Area, and thus includes data representing unexcavated areas and data from pre-confirmation subsurface soil samples collected from select deep excavation in 2012.

Riverbank soil/sediment excavation will be conducted between mid-June and September 2013. Excavation of the northern and southern areas of the riverbank will be completed when they are not inundated by river water (during lower tides) and will extend down to +2 ft MLLW or as low as possible given the conditions at the time of removal. As long as water quality is not impacted, the Contractor may extend land-based bank excavation below +2 ft MLLW.

In the north and south areas, each day’s bank excavation will be sized depending on the predicted tide levels such that excavation, back blading, confirmation sample collection, and covering with filter fabric can occur before the tide inundates any exposed surface. This work must occur at least 2 vertical feet above or 6 horizontal feet away from the water level. For confirmation sampling, each area will be divided into three units. One 6-part composite sample will be collected from each unit, as described in the QAPP (Attachment A).

Initial bank data will be compared to sediment RvALs. If sediment RvALs are exceeded in any composite sample, additional excavation of the riverbank unit represented by that sample will occur during the next suitable low tide period. Following this second round of
excavation, the area will be analyzed for indicator soil COCs. This second, i.e., further inland, sample will be compared to soil RvALs because the excavated surface would be more representative of soil exposure routes.

Fourteen surface sediment samples will be collected from the Sediment Area after dredging to design grades. Each sample will be compared to sediment RvALs. Dioxins/furans will be analyzed in six of these fourteen samples. The data are intended to be used for informational purposes only. However, EPA may require corrective action based on these data. The QAPP (Attachment A) describes the sample placement methodology.

For all areas, specific details defining the sampling methodology, analytes, and quality assurance are included in the QAPP (Attachment A).

**COCs for Excavation Completion Confirmation**
Compliance with the analytical criteria and other metrics (such as post-dredge surveys or depth of dredging) must be confirmed before excavation is considered complete and/or before backfilling of the Upland Area may begin. Confirmation samples will be analyzed on a rush basis since the in-water work window is limited, and because any Contractor downtime will have to be minimized. In soil, comparisons to all Table 4-2 RvALs, except those for silver, arsenic, and dioxins/furans, will determine whether analytical criteria are met in every grid cell. Arsenic data will not guide soil excavations because the RvALs are based on background concentrations.

All soil samples with dioxin/furan RvAL exceedances also have total PCB RvAL exceedances. However, six of the grid cells will be analyzed for dioxins/furans. This analysis may take more than one week to complete, and the sampled grid cells may not be backfilled or graded until the preliminary data are received from the laboratory. The dataset used to confirm excavation completion for dioxins/furans will include the nine samples from the pre-confirmation event and the six post-excavation samples. The six grid cells selected for post-excavation dioxin/furan analysis will depend on Contractor sequencing; those grid cells that can remain open without adversely impacting the Contractor’s work/schedule will be selected. Grid cells selected will be located throughout the Upland Area (to avoid clustering of data), and grid cells that had elevated PCB concentrations in the excavated soil (because higher dioxin/furan concentrations have historically been found with higher total PCB concentrations) will be targeted. The QAPP (Attachment A) provides further detail.

Silver is not a site-wide issue in soil, but appears to be isolated to the North Building’s septic tank/field area. Ten grid cells will be analyzed for silver, as shown in the QAPP. The nine silver samples from the pre-confirmation event will be combined with the ten post-excavation silver samples, and this combined dataset will be used to confirm excavation completion. Total PCBs, cPAHs, and TPH will be used as sitewide indicator COCs of soil excavation completion, as these COCs will be analyzed in all grid cells.
In sediment, confirmation of dredging completion will be based on achievement of sediment RvALs on a point-by-point basis in 14 surface sediment samples collected after completion of dredging and a bathymetric survey in each dredging unit. RvAL exceedances of any point data will require cleanup pass dredging of either the inner or outer row of a dredging unit, or of the entire dredging unit (depending on the exceedance level). If two cleanup passes are conducted, and data still exceed RvALs, no further dredging will be required.

**Pre-Confirmation Sampling of Deep Soil Excavations**
Some deeper excavations within the Upland Area will extend below the average groundwater elevation of +9 ft MLLW. Dewatering and possible shoring measures will be used to accomplish stable excavations, but these excavation bottoms will remain very wet, if not underwater, due to the elevation of the bottom of these excavations (as low as -1 ft MLLW). Saturated soil or standing water in the bottom of these excavations can impact the data quality and representativeness of post-excavation confirmation samples collected here.

Therefore, post-excavation confirmation sampling in these deep excavations will not be conducted (Figure 4-2). Rather, pre-confirmation subsurface soil samples were collected from the design bottom-of-excavation elevations. The Pre-Confirmation QAPP describes how these samples were collected and how they will be used in the dataset against which the Model Toxics Control Act (MTCA) 3-part rule is considered. The data from this event that will be included in the confirmation dataset are included in Table 4-3.

In the pre-confirmed grid cells, soil removal will be considered complete when the design extents and elevations are reached, as determined by a topographic survey. The design extents were adjusted deeper in 5 of these 9 grid cells, based on these pre-confirmation data. Post-excavation samples will not be collected in these grid cells because they were pre-confirmed in 2012. The descriptions of these data, and how they resulted in revision of the Pre-Final Design elevations, are included in the Excavation Verification Memorandum (Appendix K of the Design Report).

**Comparison of Soil Data to Removal Action Levels**
Soil samples collected from the Upland Area will be compared to the respective soil RvALs in Table 4-2 following the MTCA three-part rule (WAC 173-340-740 [7]) for each indicator soil COC in the following ways:

- No soil sample may exceed two times the soil RvAL for any COC. Further excavation is required in the grid cell represented by this sample.
- No more than 10% of the samples may exceed any RvAL.
- The 95% upper confidence limit (UCL) on the population mean (for each COC) may not exceed any RvAL.
An exceedance of any of these criteria triggers additional excavation (1-ft depth) in a grid cell(s) and the collection of a new post-excitation surface sample from that grid cell(s) (one new three-part composite sample). These new data will replace the data representing the excavated soil, and the population statistics for each COC will be re-evaluated. The 95% UCL will be calculated using ProUCL 4.1. Undetected data are entered at the reporting limit, and the entries are flagged in the ProUCL input file as being undetected. An Excel table will be used to determine compliance with the 10% portion of the rule. These statistical evaluations are conducted on the entire confirmation dataset. Therefore, best professional judgment and risk management decisions will need to be made as data are received, if grid cells are to be backfilled prior to the entire excavation being completed. It’s expected that decisions for the earliest-excavated grid cells will need to be conservative to ensure that the final, complete dataset for each COC meets the 3-part rule.

The soil population for total PCBs, TPH, and cPAHs is defined as the data collected from all grid cells across the entire Upland Area (excluding the north and south sloped banks). The dioxin/furan dataset includes 15 samples: 9 pre-confirmation samples and 6 post-excitation samples. The silver dataset includes 19 samples: 9 pre-confirmation samples and 10 post-excitation samples. The population includes pre-confirmation data collected from deep excavations (in Table 4-3), post-excitation surface soil samples, surface samples collected from areas where excavation will not occur (these areas may be used for soil stockpiling), and surface samples from below the North Building footprint after it’s removed. Historical subsurface samples have not been collected below the North Building, and thus this area is not characterized. The work plan for characterizing the soil below this building, for removing and sampling a UST below this building, and for designing an excavation in this area, if needed, is included in Section 4.9.

Figure 4-2 shows the sampling network. One three-part composite sample will be collected from each grid cell. Additional excavation will be completed, if needed, so data meet the three-part rule for the indicator soil COCs.

If additional Upland Area soil excavation is necessary, the data represented by the excavated soil will be removed from the dataset against which the three-part rule is computed. After additional excavation, a new sample will be collected from that grid cell and its data will be added to the dataset. If a grid cell’s excavation extends below the groundwater table, dewatering of the excavation will be required to allow field staff to collect confirmation samples.

**Data Management / Reporting**

Because sample analysis and evaluation will take two days on a rush basis, work activities will continue in another part of the site before results are received. However, the Contractor may have to mobilize equipment back to the area if results demonstrate that impacted materials remain. During the time that the samples are being analyzed, other site activities may continue, but no backfilling of those areas awaiting confirmation data may take place.
Laboratory analysis of all confirmation samples (with the exception of dioxin/furan analyses) will be conducted on a quick turn-around-time basis (48-hour maximum) so that decisions regarding the completeness/adequacy of excavation can be made in a timely manner. Analytical results will be reported to the QAO electronically, as soon as they are available, prior to validation being performed. Decisions regarding the completion/adequacy of excavation will be based on comparisons to the RvALs in Table 4-2 and in consultation with the EPA RPM.

The Contractor, the Port, and the EPA RPM will be notified immediately of the findings of each sampling event, and will receive preliminary data as soon as it is available. If corrective actions are necessary, the Port RE will direct the Contractor to take such actions. The Contractor may demobilize equipment (or begin the next phase of construction, such as backfilling) as soon as preliminary results confirm that RvALs have been met.

All data will be provided by the laboratory in electronic data deliverable format within one month of the completion of the analyses. Data validation will be performed by a qualified environmental consultant or data validation firm, and all validated sample results and relevant metadata (including sample coordinates) will be maintained in the Port database. The Removal Action Construction Report will include an electronic deliverable of all validated data, the data validation reports, and any supporting metadata, such as coordinates/elevations.

**Evaluating Impacts to the Sediment Area Perimeter**

Although appropriate BMPs will be used during dredging and all other in-water activities, there is a potential for residuals to contaminate surface sediment outside of the Sediment Area. Additionally, dredging of contaminated sediments will occur across the LDW from T-117 in the Boeing Plant 2/Jorgensen Forge Early Action Area.

Sediment samples will be collected along the perimeter of the Sediment Area, both before dredging and after backfill placement. These data will be used to assess potential changes in sediment quality associated with remedial activities in T-117 and in other nearby clean-up areas. Surface sediment (0-10 cm) samples from 5 locations 50 to 75 ft from the Sediment Area boundary (Figure 4-2) will be analyzed for the sediment COCs. The results will be documented in the Removal Action Construction Report and will not be used to trigger additional action.
## Table 4-1 Construction Elements and Monitoring

<table>
<thead>
<tr>
<th>Construction Element</th>
<th>QA Requirement</th>
<th>Frequency¹</th>
<th>COCs²</th>
<th>Performance Standard</th>
<th>CQAP Section for more Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Excavation (first pass)</td>
<td></td>
<td>Three samples (from transects) in north and south bank units. Each transect is a three-part composite, and soil from two transects in each unit are combined into one sample.</td>
<td>All sediment COCs except dioxins/furans</td>
<td>No exceedance of any sediment RvALs in any sample</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>Bank Excavation (additional passes if required)</td>
<td></td>
<td>Re-sample units that exceeded RvALs after first pass.</td>
<td>Soil Indicator COCs: PCBs, cPAH, and TPH</td>
<td>No exceedance of any indicator soil RvAL</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>TSCA Soil Excavation</td>
<td>Confirm completion of excavation and achievement of RvALs</td>
<td>No post-excavation samples</td>
<td>Prisms were pre-confirmed by PCB Aroclor data.</td>
<td>TSCA excavation design captured all soil &gt; 50 mg/kg dw total PCBs.</td>
<td>4.5.3.1</td>
</tr>
<tr>
<td>Non-TSCA Soil Excavation (prisms not inundated by groundwater)</td>
<td></td>
<td>One bottom sample in every grid cell; each sample is a composite of three surface soil grabs.</td>
<td>Soil Indicator COCs; plus silver in 10 grid cells and dioxins/furans in 6 grid cells</td>
<td>MTCA 3-part rule: No sample more than 2x RvALs; no more than 10% above RvALs; 95% UCL to be below RvALs.</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>Non-TSCA Soil Excavation (prisms inundated by groundwater)</td>
<td></td>
<td>No post-excavation samples; excavation extent was characterized by pre-confirmation data collected in 2012, described in the Pre-Confirmation Sampling QAPP.</td>
<td></td>
<td></td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>Sediment Dredging</td>
<td></td>
<td>14 samples</td>
<td>Sediment COCs; dioxins/furans in 6 samples</td>
<td>No exceedance of any sediment RvALs in any sample; offshore and nearshore rows evaluated separately. See QAPP (Attachment A)</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>Sediment Perimeter</td>
<td>For information</td>
<td>Five samples located around Sediment Area sampled two times</td>
<td>Sediment COCs and SMS chemicals</td>
<td>Pre- and post-dredging samples for information</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td>Soil Stockpiling on Clean Areas</td>
<td>Confirm that stockpiles have not re-</td>
<td>One sample in every grid cell in unexcavated areas; each sample is a composite of three grabs.</td>
<td>Soil Indicator COCs</td>
<td>MTCA 3-part rule in unexcavated grid cells. In previously excavated</td>
<td>4.8.3</td>
</tr>
<tr>
<td>Construction Element</td>
<td>QA Requirement</td>
<td>Frequency</td>
<td>COCs</td>
<td>Performance Standard</td>
<td>CQAP Section for more Details</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
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<td>------</td>
<td>----------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td><strong>Unexcavated Areas</strong></td>
<td>contaminated clean areas</td>
<td>piles are on areas previously excavated and backfilled, one 3-part composite for every 2,500 sq ft occupied by the pile will be collected.</td>
<td>COCs</td>
<td>areas, no single sample may exceed any soil RvAL.</td>
<td>4.5.3.2</td>
</tr>
<tr>
<td><strong>Unsampled Area and UST Removal under North Building</strong></td>
<td>One sample in every grid cell; each sample is a composite of three grabs.</td>
<td>Soil Indicator COCs; one of these grid cells will be analyzed for dioxins/furans.</td>
<td>MTCA 3-part rule. Combine with excavation confirmation samples to create confirmation dataset for entire Upland Area</td>
<td>4.9</td>
<td></td>
</tr>
<tr>
<td><strong>Soil Backfilling</strong></td>
<td>Backfill material is of suitable chemical quality</td>
<td>One sample for every source.</td>
<td>SMS chemicals, TPH, and dioxins/furans</td>
<td>One-half of SQS for metals; 2 mg/kg for silver; 7.3 mg/kg for arsenic; 4 ng TEQ/kg dw for dioxins/furans; no detections of SVOCs or PCBs</td>
<td>4.10 and 4.11</td>
</tr>
<tr>
<td><strong>Sediment Backfilling</strong></td>
<td>Six borings after building and foundation removal to determine if excavation needed. One sample in every grid cell after excavation; each surface sample is a composite of three grabs.</td>
<td>All soil COCs plus BTEX (to characterize potential UST-related contaminants); silver analysis in borings and in these confirmation grid cells</td>
<td>Design excavation to extend below RvAL exceedances in borings. After excavation comply with MTCA 3-part rule. UST to be removed and any soil that exceeds BTEX criteria.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1. More detail on sampling frequency/methodology is provided in the QAPP (Attachment A).
2. COCs and RvALs are listed in Table 4-2.
BTEX = benzene, ethylbenzene, and toluene; COC = contaminant of concern; MTCA = Model Toxics Control Act; RvAL = removal action level; SMS = Sediment Management Standards; SQS = Sediment Quality Standard; SVOC = semivolatile organic compound; UST = underground storage tank.
## Table 4-2 Removal Action Levels

<table>
<thead>
<tr>
<th>Contaminant of Concern</th>
<th>Removal Action Level</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soil</td>
<td>Sediment</td>
</tr>
<tr>
<td><strong>Indicator COCs analyzed in all samples</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Petroleum Hydrocarbons</td>
<td>200 mg/kg dw</td>
<td>n/a; not a sediment COC</td>
</tr>
<tr>
<td></td>
<td>(as diesel in top 6 ft)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2,000 mg/kg dw</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(as sum of diesel and lube oil ranges)</td>
<td></td>
</tr>
<tr>
<td>cPAHs</td>
<td>140 µg TEQ/kg dw</td>
<td>90 µg TEQ/kg dw</td>
</tr>
<tr>
<td>Total PCBs</td>
<td>0.65 mg/kg dw</td>
<td>12 mg/kg oc</td>
</tr>
<tr>
<td>2-Methyl naphthalene</td>
<td>n/a</td>
<td>38 mg/kg oc</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>n/a</td>
<td>16 mg/kg oc</td>
</tr>
<tr>
<td>Anthracene</td>
<td>n/a</td>
<td>220 mg/kg oc</td>
</tr>
<tr>
<td>Dibenzofuran</td>
<td>n/a</td>
<td>15 mg/kg oc</td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>n/a</td>
<td>160 mg/kg oc</td>
</tr>
<tr>
<td>Fluorene</td>
<td>n/a</td>
<td>23 mg/kg oc</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>n/a</td>
<td>100 mg/kg oc</td>
</tr>
<tr>
<td>Phenol</td>
<td>n/a</td>
<td>420 µg/kg dw</td>
</tr>
<tr>
<td>Arsenic</td>
<td>n/a; not an indicator of soil completion</td>
<td>12 mg/kg dw</td>
</tr>
<tr>
<td><strong>For confirmation in a subset of grid cells/sediment samples only</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>2 mg/kg dw (10 grid cells*)</td>
<td>n/a; not a sediment COC</td>
</tr>
<tr>
<td>Dioxins/furans</td>
<td>11 ng TEQ/kg dw (6 grid cells*)</td>
<td>13 ng TEQ/kg dw (6 samples)</td>
</tr>
<tr>
<td><strong>Not to be analyzed in soil</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>7.3 mg/kg dw; not to be analyzed; not an indicator for soil completion</td>
<td>n/a; arsenic to be analyzed in sediment; see above</td>
</tr>
</tbody>
</table>

### Notes:

1. oc = organic carbon normalized; if sample-specific total organic carbon (TOC) is between 0.5 and 4%, dry weight concentrations of non-polar organic compounds analyzed in sediment will be normalized using the sample-specific TOC. If TOC is outside this range, data will be compared to the lowest apparent effects thresholds.  
2. TEQ = toxicity equivalent; dioxin/furan and cPAH TEQs will be calculated using 2004 California EPA and 2005 World Health Organization mammalian toxicity equivalency factors, respectively.  
3. n/a = not applicable, not a COC for this medium/scenario; RvAL = removal action level; SMS = Sediment Management Standards; SQS = sediment quality standard.  
4. The silver and dioxin/furan data from the 9 pre-confirmation grid cells will be included in the confirmation dataset.
### Table 4-3  Pre-Confirmation Data from Nine Deep Excavation Grid Cells Included in Confirmation Dataset

<table>
<thead>
<tr>
<th>Grid Cell</th>
<th>Sample ID</th>
<th>Total PCBs (mg/kg dw)</th>
<th>TPH (diesel/diesel + lube oil; mg/kg dw)</th>
<th>cPAHs (µg TEQ/kg dw)</th>
<th>Dioxins/Furans (ng TEQ/kg dw)</th>
<th>Arsenic (mg/kg dw)</th>
<th>Silver (mg/kg dw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>SB-01-8,3-1</td>
<td>0.31</td>
<td>61/84</td>
<td>3.3</td>
<td>0.5</td>
<td>5 U</td>
<td>0.3 U</td>
</tr>
<tr>
<td>02</td>
<td>SB-02-8,1</td>
<td>0.25</td>
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Note: The data in this table were collected in 2012 to pre-confirm excavation grades in 9 grid cells that are to be excavated below the groundwater table. The data represent the Final Design excavation surfaces, and the elevations were adjusted (from Pre-Final to Final Design) in 5 of the grid cells based on the data collected for pre-confirmation. Data are described in the Excavation Verification Memorandum (Appendix K of the Design Report).

1. U = undetected at reporting limit listed.
4.6 Transportation and Disposal of Dredged Sediments

4.6.1 Description

Dredged sediments will be transferred from the haul barges to an upland area at a transloading location to be designated by the Contractor in the RAWP. Dredged material will be offloaded from the transfer barge to an upland staging facility and then transferred to land-based transportation (trucks or rail) for eventual final disposal at an approved landfill. The transload facility will be required to obtain and maintain all required permits to operate as a transload facility for the anticipated waste streams. The Contractor is responsible for QA of transload operations, as the facility operator will be a subcontractor to the prime construction Contractor.

4.6.2 Quality Control Measures

Specific BMPs to prevent releases of contaminated material (prevent spilling, track-out, stormwater runoff) from the transload facility include:

- Loading of sediment and debris into lined intermodal containers will be performed in lined containment areas.
- The transload facilities will be permitted through its industrial SWPPP to operate as a transload facility for the anticipated CERCLA waste streams.
- Containment areas will be designed so that fluids from the transloading operations can be collected separately from other site stormwater.
- The fluid collected from transloading operations will be disposed of with the other waste generated from the site (included with the sediment for disposal) or treated and discharged in accordance with approved permits of the transload facility.
- Rail cars or trucks will be water tight if the sediment does not pass the paint filter test (Method 9095). This may require that a liner be installed.
- The sides of trucks or rail cars will be protected with shields or spill aprons from waste material that may drop prematurely from transfer buckets.
- Trucks or rail cars will not be filled completely, such that a minimum free board distance of 6 or 36 inches, respectively, is maintained.
- Inside the transload facility, material deflected from spill aprons will land on secondary containment areas outside the area typically traveled by trucks or rail cars to avoid tracking material on tires or wheels.
- Transload facility will be designed with a spill apron to prevent material from falling into the water between the barge and the dock.
- The travel of buckets used to transfer sediment from barges to trucks or rail cars will be limited such that they are always above the barge, the spill apron, or a lined loading area.
• The operator of the equipment used to remove material from the transport barge is required to maintain the swing path of the transfer bucket over the spill apron and dump the transfer bucket in such a way that splashing is minimized.

• The operator of the equipment used to load railcars and/or trucks will be required to maintain the swing path of the transfer bucket over a spill apron and to load the railcars and/or trucks in such a way to minimize splashing.

• The loading areas will be inspected following loading of each truck and/or railcar. Any spilled material will be immediately cleaned up to minimize tracking of impacted material.

• Material spilled on the containment pad will be immediately cleaned up to protect tires that may come in contact with the waste and to minimize contamination of precipitation that may fall on the pad.

• Trucks and rail cars will be thoroughly inspected before the truck or rail car is cleared to leave the containment pad.

• Trucks or rail cars will not be overloaded. Under loading may be required to ensure that loss from sloshing does not occur.

• The transload area and all equipment used in transloading will be cleaned and decontaminated upon completion.

4.6.2.1 Waste Tracking

It is understood that the CERCLA waste needs to be tracked from the site to ultimate disposal. There may be other LDW EAA cleanups occurring at the same time as the T-117 activities, and there may be other dredging work in the area where the removed sediment could be processed through an existing sediment transload facility. A transload facility should be allowed to process waste (sediments) from more than a single site at one time. The weight of sediment from each individual site could be accurately calculated prior to offloading by the barge displacement method, and all waste would be co-mingled once removed from the barges from the individual sites. Tracking waste from the transload site to the final disposal would be accomplished by recording individual containers/trucks that leave the transload site and recording when the individual container/truck is weighed and spilled at the final disposal site.

4.6.3 Environmental Controls, Monitoring, and Corrective Action

The Contractor and operator of the transload facility will monitor the transload operations and inspect transport containers as they leave the loading/decontamination area. If leakage or track-out is detected, the Contractor or operator will take the necessary actions to stop the leakage and immediately clean any leakage or track-out as required in the facility operation permits and stormwater pollution prevention plans.

The Contractor (and operator of the transload facility) will conduct all sampling, analysis, reporting, and obtain any necessary EPA approvals for operation of the transload facility
and for ultimate final disposal of the waste. The transload facility and final disposal facility both must be approved by EPA under the Off-Site Rule.

4.7 Shoring

4.7.1 Description
Temporary shoring may be used during soil excavation to prevent earth movement and damage to adjacent utilities, structures, and roadways surrounding T-117. Excavation areas requiring support will be identified by the Contractor. The Contractor will design all temporary shoring (except for the sheet pile wall) using existing subsurface data and additional information generated, if required. The Contractor’s Site-specific HASP will describe worker safety related to installing, working near, and removing shoring.

4.7.2 Quality Control Measures
Excavation support systems will be designed to withstand all anticipated loads from soil, groundwater, equipment and building surcharge, construction loading, and seismic events (if appropriate for temporary shoring). Shoring installation may be difficult due to cobbles, large boulders, and other obstructions in the subsurface. The Contractor shall take into consideration in the preparation of the Excavation Support System Plan the likelihood of needing to pre-trench the shoring alignment or to remove or drill and split oversized material from the alignment of the shoring in order to facilitate installation.

4.7.3 Environmental Controls, Monitoring, and Corrective Action
The proposed temporary shoring support system submittal will be reviewed by the Port and City, as part of the RAWP, prior to approval to complete shoring work. The Contractor will submit the Excavation Support System Plan and relevant site geotechnical and analytical data for review.

The proposed shoring methods/details will need to consider the location of nearby utilities such as power poles, water lines, gas lines, and stormwater conveyance lines. Additional notifications to utility owners may be required, so that appropriate considerations for nearby utilities are accounted for in the temporary shoring design.

All temporary shoring will be accompanied by appropriate monitoring to demonstrate performance as described in Section 02340 - Earthwork Instrumentation and Monitoring. The Contractor will monitor and report all settlement points as indicated in the specifications and complete baseline measurements and readings as required. As specified in Section 02340, frequency of readings will increase where/when the following exceedance levels are reached:

- Ground surface adjacent to site: 0.4 inches (first), 1 inch (maximum)
- Buildings: 0.3 inches (first), 0.5 inches (maximum)
- Sheet pile wall: 1.2 inches (first), 2 inches (maximum).
An exceedance will result in the following actions:

- Identify the cause of movement
- Implement the Corrective Action Plan within two hours of exceedance or notification
- Make modifications to construction procedures and means and methods as required by Corrective Action Plan
  - For settlement: Adjust excavation parameters and operation measures and reduce progress rates as required to reduce settlement reoccurrence
  - For heave: Adjust excavation parameters as required to prevent additional heave and mitigate future occurrence of heave.

In the daily reports to the Port the Contractor will document operational changes used to reduce the rate of soil movement, settlement, or heave.

### 4.8 Stockpiling and Dewatering of Soil

#### 4.8.1 Description

Excavated Upland Area and bank soil will be stockpiled on-site within the boundaries of the site in accordance with Section 02114. North and south bank sediment will be excavated when tides are low, but the soil will likely remain moist-to-wet. Although a dewatering system will be operating, sediment excavated from within the sheet pile wall, and soil excavated from deep prisms will be wet. Any dewatering of stockpiled soil will occur via gravity on the site in a lined and bermed stockpile area.

#### 4.8.2 Quality Control Measures

Soil stockpiles can generate odors and dust, a potential community health impact. Further, improperly sloped piles can slump, especially when subject to excessive precipitation. If uncontrolled, dewatered liquids from soil piles and stormwater runoff from stockpiled soil would contribute turbidity and COCs to the LDW surface water. Stockpile areas will be lined so that water infiltrating through soil stockpiles will not impact groundwater and LDW quality. Dewatered liquids collected from stockpiles will be treated, along with groundwater pumped from deep excavations and stormwater.

#### 4.8.3 Environmental Controls, Monitoring, and Corrective Action

Stockpile areas will be lined with a geomembrane designed to withstand the anticipated construction loading and to be resistant to ultraviolet loading. Liner seams will be fully sealed and tested to ensure water tightness. The Contractor will immediately repair any liner damage that occurs during use of the stockpile area.

Soil stockpiles will be covered with a 6-mil thick (minimum) polyethylene sheeting when soil is not being added to or removed from (for loading into trucks) the pile, during
precipitation, and as necessary to control dust and odors. The stockpile cover sheets will be of sufficient length and width to completely cover each stockpile.

The Contractor will provide stormwater runoff control, manage all liquids that drain from stockpiles, and reduce precipitation contact with impacted and non-impacted material contained in the stockpile area (using covers). The Contractor may collect this water and transport it offsite for treatment or may construct a temporary onsite water treatment system to treat contaminated contact water and non-contact stormwater. Contact water includes groundwater pumped form deep excavations and from within the sheet pile wall enclosure, water that drains from bermed stockpile areas, stormwater that contacts contaminated soil, and decontamination fluids. Non-contact stormwater is that stormwater generated from site asphalt after either building demolition or ground-breaking activities have begun.

If onsite treatment is used, sampling and analysis of treated discharge water will be conducted by the Contractor. Discharge back to the LDW will be in substantive compliance with NPDES construction permit requirements, as described in the QAPP (Attachment A), and will be in compliance with the EPA-provided WQC. As described in Section 02245 – Construction Water Management System, a water treatment system will be required to treat any contaminated contact water, i.e., water that contacts impacted soil or sediment, and any site stormwater. The design, operation, and monitoring of this system will be the responsibility of the Contractor. Any water discharged to the LDW will need to meet marine chronic criteria for total PCBs (0.03 µg/L) and metals at the end of the pipe. Water will also be analyzed for field parameters, such as turbidity. Two samples will be analyzed for TPH, cPAHs, and dioxins/furans for informational purposes. Additionally, two whole effluent toxicity tests will be performed on the treated water discharge (see QAPP; Attachment A).

Wheel wash water will be circulated within the wheel wash system. When the water is spent, it will be transported offsite for treatment and disposal at an EPA approved facility. It will not be treated by the onsite system.

Although the system will be designed by the Contractor, specification Section 02245 identified minimum components including an oil/water separator, a solids removal technology, carbon filtration, and pH or dissolved oxygen treatment. Carbon filters will likely be installed in sequence, with sampling ports at the outflow of each filter. When sampling data show COC breakthrough on the first filter, flow is to be diverted to first pass through the second in-line filter. The first filter is replaced, and receives the outflow from the second filter.

Because almost the entirety of the Upland Area is to be excavated, the soil stockpile locations will likely be transient to accommodate excavation and backfilling. The areas used will be clearly recorded by the Contractor in daily reports to the Port. If soil is stockpiled on a previously excavated (and clean) area, one 3-part composite surface soil sample will be collected for every 2,500 sq ft occupied by the pile after the soil has been transported
offsite (and after the area is no longer used for stockpiling). Although stockpile areas must be lined, according to the specifications, tears may occur, and contaminated soil, soil dewatering liquids, or contact stormwater may impact underlying clean soil. These samples will not be included in the dataset used to determine compliance with the MTCA 3-part rule. In these previously excavated/backfilled areas, the data collected from the excavated surface are in the confirmation dataset. If soil is stockpiled on an area that will not be excavated, the confirmation samples for evaluation of the 3-part rule will be collected after the piles, liners, etc. are removed. In these “no excavation” areas, the same data will be used to determine whether the stockpile has contaminated underlying soil and to evaluate compliance with the MTCA 3-part rule.

4.9 Characterization of North Building Soils

4.9.1 Description

Because the North Building is unsafe for entry, soil below the building foundation has not been characterized. After foundation removal, six soil borings will be advanced to collect subsurface soil samples. One-foot soil samples will be collected 0, 1, 2, 3, 5, 7 and 10 ft bgs. The North Building includes portions of 4 confirmation grid cells. Three borings will be placed in the southern grid cell, and one boring will be placed in each of the three northern grid cells. In each boring, the shallowest sample will be analyzed, and the deeper samples will be archived. Additional detail is included in the QAPP (Attachment A).

The southern side of the building was constructed at a later date than the portion of the building over the three northern grid cells. Additionally, this part of the building is near a historical roadway and near an area excavated during the 2006 TCRA. Existing data in this area are shallow and do not vertically bound contamination. Therefore, the three borings will be collected across the southern half of the building. In all borings, soil will be analyzed for silver, TPH, PCBs, and cPAHs. The deepest sample that ends up being analyzed in each boring will also be analyzed for dioxins/furans. The QAPP identifies sample coordinates and analytes and displays these boring locations on a map. If RvAL exceedances are identified, soil will be excavated below these exceedances.

A suspected heating oil UST is located below the building. After building demolition, this UST must be decommissioned and removed.

4.9.2 Quality Control Measures

Following building removal and any necessary soil excavation, surface soil confirmation samples will be collected in the same manner as those collected for Upland Area soil excavation confirmation: 3-part composite sample in each grid cell. The Contractor’s staff or subcontractor who performs UST decommissioning and removal is required to have a certification from the International Fire Code Institute (IFCI). To permanently close a UST system, the Contractor must empty and clean the tank by removing all liquids and accumulated sludges. The UST will then be triple rinsed, and those liquids will be collected...
in a vactor truck. All liquids and sludges should be removed and disposed of in an approved manner, or the removed oil may be reused if it is of a suitable composition.

4.9.3 Environmental Controls, Monitoring, and Corrective Action

Following UST removal, an assessment of remaining soil conditions must be completed by a person (consultant to the Port) certified by Ecology accordance with WAC 173-360-610 or completed by a Washington registered professional engineer supporting the RE who is competent, by means of examination, experience, or education, to perform site assessments. The excavation area will be visually observed for signs of contamination/releases from the UST. If no visible contamination is identified, 1 bottom sample and two sidewall samples (composited across a 2-ft depth range) will be analyzed for TPH and BTEX. Any visibly contaminated soil must be excavated. Any soil with TPH over the RvAL must be removed, and any soil with BTEX over Method A cleanup levels must be removed. After all soil removal associated with the UST and with the North Building soil characterization has been completed, one 3-part composite confirmation sample will be collected from the soil surface in each grid cell.

4.10 Placement of Soil Backfill

4.10.1 Description

Following soil excavation, the Upland Area and bank will be backfilled with imported soil to the grades shown in Drawings C026 through C028 (Backfill Grading Plan). Once the upland removal has been completed and confirmation data demonstrate compliance with RvALs some site regrading may occur to prepare the area for final backfill with imported material. No backfilling may begin until the soil confirmation data (bottom of excavation) meet RvALs. This can be evaluated on a grid cell by grid cell basis, i.e., all confirmation data do not have to be collected before some regrading and backfilling may begin (as long as data have demonstrated that the subject grid cell’s excavation is adequate or that further excavation is not anticipated in that grid cell to satisfy statistical criteria). Compliance will require risk management decision-making on areas backfilled before the entire dataset is generated. All imported backfill material must meet gradation and chemical quality criteria and will be obtained from sources that have been pre-approved in accordance with Specification Section 02300 – Earthwork and with Section 02992 – Hydroseeding and Landscaping.

4.10.2 Quality Control Measures

Soil used on-site must be of suitable chemical and physical quality such that the T-117 EAA and the LDW are not recontaminated. Further, the soil must be of specific structural quality and must be graded and compacted sufficiently to support future site uses.

Some soil prisms will be excavated below the groundwater table. These prisms must be backfilled with import gravel borrow (that meets the chemical and physical criteria in Section 4.10.3) in 2-ft (maximum) lifts to above the standing water. They may not be
backfilled with higher-elevation regarded site soil, which is likely finer-grained than soil under the groundwater table. The gravel backfill must be compacted with a hoe-pack compactor over the entire area of or by at least 3 passes with a 10-ton vibratory compactor.

Regraded soil is expected to have a variable grain size. It may be placed into deeper areas, not containing standing water, in 1.5-ft maximum thickness lifts. It must be compacted by at least 3 passes of a 10-ton compactor.

In all areas after backfilling to grades defined in the Final Grading Plan (Drawing C026), compaction control density will be 90% (within 2 ft of final ground surface) or 95% (in the upper 2 ft) of the maximum density at optimum moisture content as determined by ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort, Methods A or B as applicable. Field tests to determine in-place compliance with required densities as specified, will be performed in accordance with ASTM D1556, D2167, or D6938. An independent testing firm will be required to document compliance with chemical, physical, and placement requirements of the backfill.

4.10.3 Environmental Controls, Monitoring, and Corrective Action

Regraded soil must be observed for debris and visual contamination. An identification of either would require soil/debris removal. Regraded soil may not be placed into wet excavations until gravel borrow has been placed to elevations above the groundwater table.

Laboratory and field tests will be performed in accordance with the applicable provisions of Section 02300 - Earthwork, to determine compliance with the specifications.

The Contractor will furnish soil samples suitable for the laboratory tests at no cost to the Port. Prior to any onsite placement of import materials, the Contractor will submit representative physical and chemical test results of materials for acceptance by the Port and EPA. One sample per source will be analyzed for gradation/physical factors and chemistry. Additionally, if the source of the import material changes, additional sampling will be required.

A report will be submitted with the test results that identifies the origin of the materials. Chemical testing will be completed by the Contractor or Contractor’s suppliers according to the specifications. No material will be placed onsite until EPA has approved the test results. Specific test requirements are contained in Section 02300 - Earthwork.

Soil will be tested for:

- Sieve analyses and comparison to the WSDOT Standard for the imported material.
- Moisture density curve for the Gravel Borrow, in accordance with ASTM D-1557 (Modified Proctor).
- Petroleum hydrocarbons (NWTPH-Dx)
- SMS metals (EPA SW 846 6010B/6020/7000 Series)
- SMS semivolatile organic compounds (EPA Method 8270)
- PCBs (Method 8082)
- Dioxins/furans (EPA Method 8290 or Method 1613).

Only backfill material that meets the following chemical quality requirements will be used:

- Undetected for PCB Aroclors, semivolatile organic compounds, and petroleum hydrocarbons
- Below 7.3 mg/kg dw for arsenic
- Below 2 mg/kg dw for silver
- Below 4 ng TEQ/kg dw for dioxins/furans
- Below one-half of the SQS for metals other than arsenic and silver.

Imported rip rap will meet the following requirements:

- Specific gravity of at least 2.55
- Degradation factor minimum of 15
- Freeze/Thaw <10%
- Absorption maximum of 3%
- Expansive breakdown (15-day) less than 8.5%
- Los Angeles wear no more than 50%.

Gravel borrow backfill and rip rap must meet the grain size requirements in Table 4-4. Excavated soil (and regarded soil) will be covered by at least 12 inches of imported gravel borrow. After backfill grades are achieved, the surface will be hydroseeded.

### 4.11 Placement of Sediment Backfill

#### 4.11.1 Description

This task involves backfilling of the excavated sediment prism to the pre-removal grade (or to lower grades; 8 ft MLLW near the Marina) after post-dredging confirmation data are deemed acceptable (i.e., meet RvALs).

#### 4.11.2 Quality Control Measures

The source of the import materials will be an approved upland site and will conform to Specification Section 02325 - Dredging. The main quality control aspects of the backfilling process include:

- Thickness and Extent. Material must be satisfactorily placed over the dredged area to the elevations indicated on Drawings C026 through C028.
• Verification of Import Material Quality. The chemical and physical characteristics of the material will be verified through Contractor submittals, to conform with Section 02325 of the specifications.

• Limiting Turbidity Generation. Resuspension of bottom sediments and the descent of backfill material through the water column can generate excessive turbidity.

4.11.2.1 Thickness and Extent

Backfill thickness will be based on the pre- and post-hydrographic surveys. The Contractor will be required to place additional material where the required thickness is not attained, based on post-backfill surveys. Payment will not be made for thicknesses exceeding the over-placement allowance.

4.11.2.2 Verification of Import Material Quality

Prior to any onsite placement of import materials, the Contractor will submit representative physical and chemical test results of materials for acceptance by the Port and EPA. One sample will be analyzed for gradation/physical factors and chemistry. If the source of the import material changes, additional sampling will be required.

A report will be submitted with the test results that identifies the origin of the materials. Chemical testing will be completed by the Contractor or his suppliers according to the specifications. No material will be placed in the water until EPA has approved the test results. Specific test requirements are contained in Section 02325 - Dredging.

Backfill sand must meet the gradation requirements in Table 4-4 and must meet the following other physical requirements:

• Degradation factor minimum of 15
• Los Angeles wear of no more than 50%
• Bulk specific gravity of at least 2.55.

Chemical concentrations of the imported material must be at or below one-half the SQS for all SMS metals except arsenic, which must be below 7.3 mg/kg dw (because it is a human health risk driver for the LDW with risk based threshold concentrations below natural background). Organic SMS chemicals must be undetected in every sample. Dioxin/furan concentrations must be below 4 ng TEQ/kg dw.

In addition to the physical and chemical characterization testing described above, the Contractor will visually inspect import material upon delivery to the site for the presence of foreign, recycled, or reprocessed materials. The presence of such materials will be cause for rejection and return to the supplier.
4.11.2.3 Limiting Turbidity Generation

Resuspension of bottom sediments and the descent of backfill material through the water column can generate excessive turbidity. The potential for these effects is limited by the Contractor’s use of BMPs and equipment. Water quality monitoring as described in the WQMP, and the WQC will verify that water quality criteria are not exceeded during placement of sediment backfill.

4.11.3 Environmental Controls, Monitoring, and Corrective Action

Water quality monitoring and oil spill control measures will be conducted during backfilling activities. A subcontractor to the Contractor will monitor water quality as described in the WQMP, and the Contractor will continuously visually monitor for sheens or floatable materials whether they originate from the sediment or the Contractor’s equipment.

Design elements and performance requirements to minimize water quality impacts include:

- Selecting materials with a low fines content
- Requiring placement methods that minimize any resuspension of bottom sediments
- Placement of an initial lift of materials not to exceed 2 feet.

The RAWP will identify additional BMPs, operational controls, and equipment options available for minimizing water quality concerns for day-to-day operations and for addressing potential contingencies related to water quality exceedances. The following elements will be implemented, if necessary, to control for turbidity/water quality impacts:

- Limiting hours of operation to favorable tidal cycles (e.g., avoiding certain tidal periods if they appear to be associated with unacceptable turbidity)
- Decreasing the rate of placement and/or placing in thinner lifts
- Releasing materials from bucket just above the sediment surface
- Stopping work.

The Contractor will keep daily records during backfill placement using the Daily Construction Report, which will include:

- Shipping receipts and material volumes for all import fill materials
- Daily and weekly volume estimates and locations of materials placed.
4.12 Reuse of Existing Backfill

4.12.1 Description
In 2006, a time-critical removal action was conducted in four areas in the T-117 Upland and bank. After the soil removal, crushed rock backfill was laid over geotextile fabric. In 2008 and 2011 riverbank repair events were conducted, and rip rap and boulder placement returned the bank face to its pre-repair grade. These backfill materials are believed to be clean because they are separated from underlying contaminated soil by fabric, and the crushed rock from the 2006 work will be analyzed to confirm this.

They are to be re-used onsite as backfill. They will be excavated and stockpiled in a separate location than contaminated soil.

4.12.2 Quality Control Measures
The fabric separating any backfill material from underlying soil will be inspected for tears, gaps, and signs of wear. The fabric must be intact for the material to be reused. Further, the material must be free of visible soil, oil, and foreign debris. Lastly, two samples of fines from the crushed rock from the 2006 removal action will be submitted for laboratory analysis. The samples must meet the soil backfill chemistry requirements in Section 4.9.3.

4.12.3 Environmental Controls, Monitoring, and Corrective Action
If the materials do not meet the requirements for backfill in Section 4.9.3, they may not be used as site backfill, and they will be disposed in a suitable landfill.

4.13 Pile Driving

4.13.1 Description
Replacement piles will be installed at the Marina for supporting floats and the debris deflector. These piles will be installed after the completion of sediment dredging and backfilling ad prior to the end of the in-water work window. Section 02460 describes the considerations for pile installation, including the driving of all piling with a vibratory hammer (unless refusal occurs before the design elevation is achieved), staging of piles, and the use of a bubble curtain to limit noise impacts to the aquatic environment.

4.13.2 Quality Control Measures
Pile installation is to occur with a vibratory hammer, unless refusal occurs prior to achieving the design elevation. In those instances, an impact hammer will be used to drive to the design elevation. All pile driving will occur with the use of a bubble curtain to limit sound propagation in the LDW. This BMP and its expected effectiveness at protecting threatened and endangered fish species, is documented in the ESA Section 7 Consultation Biological Assessment.
Piling and appurtenant materials will be certified by the manufacturer to meet the specified material and section property requirements. Prior to installation, the pile will be inspected by the Construction Management Team and the Contractor to demonstrate that they meet the requirements in Section 02460. The Contractor will install the steel piles to within the following tolerances:

- Maximum Variation from Vertical For Plumb Piles: 1 in 200
- Maximum Variation From Top of Pile Elevation: 3 inches
- Maximum Horizontal Out-of-Position: 2 inches

4.13.3 Environmental Controls, Monitoring, and Corrective Action

The Contractor, RE, and DL will each inspect various components of the pile installation and performance. Only materials that meet the manufacturer’s QA tests may be delivered to the site. According to Section 02460 the Contractor will handle the pile in a manner recommended by the manufacturer to prevent permanent deflection or distortion. Any damage that does occur will be drawn to the attention of the RE, and the Contractor will submit his proposal for corrective action for approval by the RE prior to commencement. Piling that is damaged during handling will be repaired or replaced at the Contractor’s expense.

Piling will be installed by the Contractor with a vibratory hammer of the correct size and by methods approved by the RE so as not to subject the piling to damage. Pile driving will occur during the in-water work window and a bubble curtain will be used during hammer operation to limit sound propagation in the LDW. During pile driving any water quality exceedances will be addressed through the process in the WQMP.

4.14 Relocation of South Park Marina Floats

4.14.1 Description

To allow room for maneuvering of dredging equipment at the downstream end of the Sediment Area, floats and vessels in the upstream end of the Marina will likely be moved and temporarily stored in an alternate location within the Marina. The floats and vessels will be detached from the piles, moved, and stored by the Marina owner. The Contractor will remove the piles prior to dredging, and will install replacement piles after backfilling. The specifics will be described in the Contractor’s RAWP. The floating dock will be temporarily stored by the Marina owner and then returned to its original location/configuration. The removed piling will be placed on a barge and will be disposed of or recycled with other removed debris. The Contractor’s Dredging Plan will document the plan for this work.
4.14.2 Quality Control Measures

QC measures will focus on controlling the pile removal effort to make sure that the work is completed within the requirements of the WQMP, and making sure that new piles that are installed meet quality control requirements.

4.14.3 Environmental Controls, Monitoring, and Corrective Action

The WQMP addresses monitoring of, and corrective actions for, water quality impacts, which may include scheduling these activities with favorable tidal conditions.
### Table 4-4  Gradation Requirements for Backfill Materials

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
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<tbody>
<tr>
<td><strong>Soil backfill – gravel borrow</strong></td>
<td></td>
</tr>
<tr>
<td>4”</td>
<td>99-100</td>
</tr>
<tr>
<td>2”</td>
<td>70-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>50-80</td>
</tr>
<tr>
<td>No. 40</td>
<td>≤30</td>
</tr>
<tr>
<td>No. 200</td>
<td>≤7</td>
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<tr>
<td><strong>Sand equivalent</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥50</td>
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<tr>
<td><strong>Riprap</strong></td>
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<tr>
<td>18”</td>
<td>100</td>
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<tr>
<td>16”</td>
<td>80-95</td>
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<tr>
<td>12”</td>
<td>50-80</td>
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<td>8”</td>
<td>15-50</td>
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<tr>
<td>4”</td>
<td>≤15</td>
</tr>
<tr>
<td><strong>Sediment backfill - sand</strong></td>
<td></td>
</tr>
<tr>
<td>3/8 inch</td>
<td>99-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>95-100</td>
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<tr>
<td>No. 16</td>
<td>45-80</td>
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<td>No. 30</td>
<td>15-55</td>
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<td>5-30</td>
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</tr>
<tr>
<td>No. 200</td>
<td>0-2.5</td>
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5 References


Figures
SOIL REMOVAL IN THIS AREA IS 1.5 FEET BELOW THE CURRENT GROUND SURFACE.
WATER-WARD EXTENT OF LAND-BASED BANK ELEVATION

SOIL REMOVAL IN THIS AREA IS 1.5 FEET BELOW THE CURRENT GROUND SURFACE

PERIM-1
CONF-SG-1

PERIM-2
CONF-SG-2

PERIM-3
CONF-SG-3

PERIM-4
CONF-SG-4

PERIM-5
CONF-SG-5

CONF-SG-10
CONF-SG-11
CONF-SG-12
CONF-SG-13
CONF-SG-14

PERIMETER SAMPLE LOCATION
CONFIRMATION SAMPLE LOCATION

DREDGING CONTOUR
BOTTOM ELEVATION OF EXCAVATION IN FT MLLW
EXCAVATION UNDER THE NORTH BUILDING WILL BE DELINEATED BY SOIL DATA COLLECTED AFTER BUILDING DEMOLITION
BANK CONFIRMATION SAMPLING TRANSECT
SOIL SAMPLING GRID CELL
MULTIPLE PRISMS IN THE SAMPLING GRID CELL

NO EXCAVATION AREA
PRISM FOR WHICH PRE-EXCAVATION DATA WILL BE USED TO CONFIRM EXCAVATION COMPLETION. POST-EXCAVATION CONFIRMATION SAMPLES WILL NOT BE COLLECTED.

DREDGE UNIT
T-117 STUDY AREA

CONSTRUCTION QUALITY ASSURANCE PLAN
QUALITY ASSURANCE PROJECT PLAN
T-117 EARLY ACTION AREA

CONFIRMATION SAMPLING LOCATIONS AND UPLAND GRID

FIGURE 4-2
Attachment A
Draft Quality Assurance Project Plan
CONSTRUCTION QUALITY ASSURANCE PLAN
ATTACHMENT A: QUALITY ASSURANCE PROJECT PLAN
PHASE 1: Sediment and Upland Cleanup

Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

October 5, 2012
A. Project Management

A1 Title and Approval Sheet

Construction Quality Assurance Plan
Attachment A: Quality Assurance Project Plan
PHASE 1: Sediment and Upland Cleanup
Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area
October 5, 2012
To be approved/finalized with RAWP

Project Manager________________________________________________________

Date

Quality Assurance
Officer________________________________________________________

Date

EPA Project Manager__________________________________________________
Piper Peterson

Date

EPA Quality Assurance
Manager________________________________________________________

Gina Grepo-Grove

Date
# A2 Table of Contents

A. Project Management ........................................................................................................ ii  
   A1 Title and Approval Sheet ......................................................................................... ii  
   A2 Table of Contents ......................................................................................................... iii  
   A3 Distribution List ........................................................................................................ A-1  
   A4 Project and Task Organization ................................................................................ A-1  
   A5 Problem Definition and Background ....................................................................... A-3  
   A6 Project and Task Description .................................................................................. A-3  
   A7 Quality Objectives and Criteria .............................................................................. A-6  
   A8 Special Training and Certification ......................................................................... A-9  
   A9 Documents and Records .......................................................................................... A-10  

B. Data Generation and Acquisition .................................................................................. B-1  
   B1 Sampling Process Design ....................................................................................... B-1  
   B2 Sampling Methods .................................................................................................... B-7  
   B3 Sample Handling and Custody .............................................................................. B-16  
   B4 Analytical Methods ................................................................................................... B-17  
   B5 Quality Control ........................................................................................................ B-19  
   B6 Instrument and Equipment Testing, Inspection, and Maintenance .......... B-21  
   B7 Instrument and Equipment Calibration and Frequency ................................ B-22  
   B8 Inspection and Acceptance of Supplies and Consumables ................................ B-23  
   B9 Non-Direct Measurements ...................................................................................... B-23  
   B10 Data Management .................................................................................................. B-23  

C. Assessment and Oversight Elements .......................................................................... C-1  
   C1 Assessment and Response Actions ................................................................. C-1  
   C2 Reports to Management ......................................................................................... C-2  

D. Data Validation and Usability ...................................................................................... D-1  
   D1 Data Review, Verification, and Validation ......................................................... D-1  
   D2 Verification and Validation Methods .......................................................... D-1  
   D3 Reconciliation with User Requirements ....................................................... D-2  

E. References .................................................................................................................. E-1
List of Tables

Table A4-1  Project Roles and Responsibilities
Table A6-1  Analytes, Reporting Limits, Methods, and Sample Containers for Soil and Sediment Samples
Table A6-2  Analytes, Reporting Limits, Methods, and Sample Containers for Treated Discharge Water Samples
Table A7-1  Soil and Sediment Measurement Quality Objectives
Table A7-2  Treated Discharge Water Measurement Quality Objectives
Table B1-1  Soil and Sediment Sampling Methodology and RvAL Evaluation Process
Table B1-2  Removal Action Levels
Table B1-3  Discharge Water Sampling Frequency and Criteria
Table B2-1  Upland Area Confirmation Grid Cells
Table B2-2  Upland Area Surface Soil Samples
Table B2-3  Riverbank Confirmation Samples
Table B2-4  Sediment Confirmation Samples
Table B2-5  Sediment Perimeter Samples
Table B2-6  North Building Soil Borings

List of Figures

Figure A6-1  Confirmation Sampling Locations and Grid Cells
Figure B1-1  Riverbank Confirmation Sampling Locations
Figure B1-2  Sediment Confirmation and Perimeter Sampling Locations
Figure B1-3  North Building Characterization Boring Locations

List of Attachments

Attachment A  Laboratory Standard Operating Procedure for Soil Sample Preparation
Attachment B  Soil Drying Evaluation Memorandum
Attachment C  Standard Operating Procedures and Equipment Manuals
(to be provided by Contractor and subconsultants conducting sampling)
# Acronyms and Abbreviations

<table>
<thead>
<tr>
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<th>Term</th>
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<tr>
<td>CAD</td>
<td>computer aided drafting</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>City</td>
<td>City of Seattle</td>
</tr>
<tr>
<td>COC</td>
<td>contaminant of concern</td>
</tr>
<tr>
<td>CLP</td>
<td>Contract Laboratory Program</td>
</tr>
<tr>
<td>cPAH</td>
<td>carcinogenic polyaromatic hydrocarbon</td>
</tr>
<tr>
<td>CQAP</td>
<td>Construction Quality Assurance Plan</td>
</tr>
<tr>
<td>CQCP</td>
<td>Construction Quality Control Plan</td>
</tr>
<tr>
<td>CSL</td>
<td>Cleanup Screening Level</td>
</tr>
<tr>
<td>cy</td>
<td>cubic yard</td>
</tr>
<tr>
<td>DCB</td>
<td>decachlorinated biphenyl</td>
</tr>
<tr>
<td>DGPS</td>
<td>differential global positioning system</td>
</tr>
<tr>
<td>DQO</td>
<td>data quality objective</td>
</tr>
<tr>
<td>EAA</td>
<td>Early Action Area</td>
</tr>
<tr>
<td>EDD</td>
<td>electronic data deliverable</td>
</tr>
<tr>
<td>EE/CA</td>
<td>Engineering Evaluation/Cost Analysis</td>
</tr>
<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>ft</td>
<td>foot</td>
</tr>
<tr>
<td>HASP</td>
<td>Health and Safety Plan</td>
</tr>
<tr>
<td>HAZWOPER</td>
<td>Hazardous Waste and Emergency Operation</td>
</tr>
<tr>
<td>LCS/LCSD</td>
<td>laboratory control sample/laboratory control sample duplicate</td>
</tr>
<tr>
<td>LDW</td>
<td>Lower Duwamish Waterway</td>
</tr>
<tr>
<td>MDL</td>
<td>method detection limit</td>
</tr>
<tr>
<td>MLLW</td>
<td>mean lower low water</td>
</tr>
<tr>
<td>MRL</td>
<td>method reporting limit</td>
</tr>
<tr>
<td>MS/MSD</td>
<td>matrix spike/matrix spike duplicate</td>
</tr>
<tr>
<td>MTCA</td>
<td>Model Toxics Control Act</td>
</tr>
<tr>
<td>NAD83</td>
<td>North American Datum of 1983 (horizontal)</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>NTCRA</td>
<td>non-time-critical removal action</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PARCC</td>
<td>precision, accuracy, representativeness, comparability, and completeness</td>
</tr>
<tr>
<td>PCB</td>
<td>polychlorinated biphenyl</td>
</tr>
<tr>
<td>PDF</td>
<td>portable document format</td>
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<tr>
<td>Phase 1</td>
<td>Sediment and Upland Areas</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Adjacent Streets and Yards Areas</td>
</tr>
<tr>
<td>Port</td>
<td>Port of Seattle</td>
</tr>
<tr>
<td>PNNL</td>
<td>Pacific Northwest National Laboratory</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>PRG</td>
<td>Preliminary Remediation Goal</td>
</tr>
<tr>
<td>PSEP</td>
<td>Puget Sound Estuary Program</td>
</tr>
<tr>
<td>QA</td>
<td>quality assurance</td>
</tr>
<tr>
<td>QAPP</td>
<td>Quality Assurance Project Plan</td>
</tr>
<tr>
<td>QC</td>
<td>quality control</td>
</tr>
<tr>
<td>RAL</td>
<td>remedial action level</td>
</tr>
<tr>
<td>RAO</td>
<td>remedial action objective</td>
</tr>
<tr>
<td>RAWP</td>
<td>Removal Action Work Plan</td>
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<td>RPD</td>
<td>relative percent difference</td>
</tr>
<tr>
<td>RvAL</td>
<td>removal action level</td>
</tr>
<tr>
<td>Settlement Agreement</td>
<td>Administrative Settlement Agreement and Order on Consent</td>
</tr>
<tr>
<td>SMS</td>
<td>Sediment Management Standards</td>
</tr>
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<td>SOP</td>
<td>standard operating procedure</td>
</tr>
<tr>
<td>sq</td>
<td>square</td>
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<tr>
<td>SQS</td>
<td>Sediment Quality Standard</td>
</tr>
<tr>
<td>T-117</td>
<td>Terminal 117</td>
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<tr>
<td>TEQ</td>
<td>toxicity equivalent</td>
</tr>
<tr>
<td>TOC</td>
<td>total organic carbon</td>
</tr>
<tr>
<td>TPH</td>
<td>total petroleum hydrocarbons</td>
</tr>
<tr>
<td>TSCA</td>
<td>Toxic Substances Control Act</td>
</tr>
<tr>
<td>UCL</td>
<td>upper confidence limit</td>
</tr>
<tr>
<td>USACE</td>
<td>United States Army Corps of Engineers</td>
</tr>
<tr>
<td>UST</td>
<td>underground storage tank</td>
</tr>
<tr>
<td>WAC</td>
<td>Washington Administrative Code</td>
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</table>
A3 Distribution List

EPA Region 10 Remedial Project Manager: Piper Peterson
EPA QA Manager: Gina Grepo-Grove
USACE Technical Consultant to EPA: Leanna Woods Poon
Subcontractor to USACE: Greg Glass
Port Project Coordinator: Roy Kuroiwa
Port Project Manager: Ticson Mach
Port Resident Engineer: Stacy Heilgeist
Port Env. Compliance and Community Liaison: Dave Jenkins
City Project Manager: Mary Mitchener
Field Manager: to be determined
Field QA Officer: to be determined
Contractor Project Engineer: to be determined
Laboratory Project Manager: to be determined
Laboratory QA Officer: to be determined

A4 Project and Task Organization

The Port of Seattle (Port) and City of Seattle (City) jointly are the Responsible Parties for the T-117 EAA. The Port has the lead for the Upland and Sediment Area (Phase 1) portions of the T-117 EAA cleanup. The City has the lead for the Adjacent Streets and Yards (Phase 2) cleanup, which will be addressed under a separate Construction Quality Assurance Plan (CQAP). The United States Environmental Protection Agency (EPA) has lead responsibility for regulatory oversight. Port Construction Management will oversee the Phase 1 work. A general Contractor will be selected under a Public Works process to implement the work.

This draft quality assurance project plan (QAPP) is a component of the draft CQAP. Both plans will be finalized using the Contractor’s specific plan for excavation, dredging, and other activities during the Removal Action Work Plan (RAWP). They were prepared as required by the Administrative Settlement Agreement and Order on Consent (Settlement Agreement) for the Phase 1 (Upland Area and Sediment Area) of the Terminal 117 (T-117) Non-Time-Critical Removal Action (NTCRA). This QAPP describes quality assurance/quality control (QA/QC) procedures associated with collecting, analyzing, validating, and using Upland Area soil, riverbank sediment/soil, and surface sediment that will be used to verify the completeness of the soil removal and sediment dredging. Sediment samples will also be collected from the dredging perimeter. Removal of a heating oil underground storage tank (UST) and its associated soil under the North Building, as well as soil characterization for removal action level (RvAL) achievement under the North building will also be discussed. In this QAPP, excavation will refer to both soil removal and sediment dredging. It also discusses discharge water monitoring for contaminated contact water treated by an onsite water treatment system prior to release to the LDW.
This QAPP is an attachment to the CQAP. The CQAP describes the approach for confirming excavation completion. The Contractor will develop a Construction Quality Control Plan (CQCP), as a component of the RAWP, which will describe the methods for treating and monitoring contaminated contact water, for maintaining equipment, and for monitoring settlement points and shoring. The details in this QAPP related to monitoring treated contact water may be adjusted per the Contractor’s specific plan for operating the water treatment system.

This QAPP follows the format within EPA’s requirements for QAPPs (known as R-5; EPA 2001). This QAPP contains the following sections: Project Management (Section A), Data Generation and Acquisition (Section B), Assessment and Oversight (Section C), Data Validation and Usability (Section D), and References (Section E).

A4.1 Roles and Responsibilities

Roles and responsibilities are defined in Table A4-1. Piper Peterson is the EPA Remedial Project Manager. Gina Grepo-Grove is the EPA QA Manager. A Port consultant will conduct the soil and sediment confirmation sampling, the UST removal sampling, and sediment perimeter sampling. The discharge water sampling (or sampling of contact water transported offsite for treatment) will be conducted by the Contractor.

Analytical Resources, Inc. will perform chemical analyses of the soil and sediment samples. The Port and USACE will receive preliminary soil and sediment confirmation data electronically after rapid turn-around processing by the analytical laboratory. The confirmation data will be evaluated as soon as they become available, including being added to the soil dataset, so that decisions regarding the completeness of excavation can be made. If additional excavation is required, the Port Resident Engineer will direct the Contractor to complete this work. The Resident Engineer will also notify the Contractor when data show that excavation is complete, and backfilling (or subsequent project activities) may begin.

A Port consultant will collect and evaluate soil data from the UST removal under the North Building. These data will be used to evaluate whether a release from the UST occurred, and whether soil excavation is required. Soil excavation may be required under the North Building to meet RvALs. The Port (or a consultant) will collect investigative soil borings under the North Building after it is demolished. No prior data have been collected from under this building because its condition has not allowed for safe access. The borings will be used to determine whether any soil removal under the North Building is required. After the UST and any UST-impacted soil are removed, and any required soil excavation to meet RvALs is completed, three-part composite samples will be collected from the grid cells in the North Building footprint. These data will be a part of the confirmation dataset.

The Contractor will receive and evaluate water discharge data from the laboratory (laboratory to be determined by Contractor). If water quality data indicate that the water
treatment system is not operating as designed, the Contractor will be required to mitigate this issue.

Additional members of the project team include, but are not limited to public involvement staff, design team sub-consultants, Port consultants, and the Contractor’s subcontractors. Project personnel responsibilities are described in Table A4-1.

A5 Problem Definition and Background

T-117 is an Early Action Area (EAA) within the 440-acre Lower Duwamish Waterway (LDW) Superfund site. Phase 1 of this NTCRA, which will begin in spring 2013, has the following contaminants of concern (COCs) in soil: total PCBs as the sum of detected Aroclors, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) as a toxicity equivalent (TEQ) calculated with seven PAHs, arsenic, silver, dioxins/furans as a TEQ, and total petroleum hydrocarbons (TPH) as the sum of diesel and lube oil range hydrocarbons. Sediment COCs are total PCBs, cPAHs, dioxins/furans, arsenic, phenol, and some individual PAHs. The goals of the excavation are to protect ecological and human health from elevated COC concentrations in sediment and soil. Confirmation data will be compared to RvALs for indicator COCs (a subset of the COCs), which are:

- Soil: total PCBs, cPAH, and TPH in all grid cells
  - Silver and dioxins/furans will be analyzed in 10 and 6 grid cells, respectively.
  - Arsenic will not be analyzed in the confirmation dataset because its RvAL is related to background conditions, for which historical subsurface soil data indicate are met in soil below the design excavation.
- Sediment: total PCBs, arsenic, phenol, and PAHs (individual and cPAH TEQ) in all samples
  - Dioxins/furans will be analyzed in 6 samples.

A6 Project and Task Description

To achieve design grades, approximately 8,100 cubic yards (cy) of sediment will be dredged from the T-117 Sediment Area to final elevations ranging from -2 ft mean lower low water (MLLW) to -13 ft MLLW. Upland soil (35,100 cy of non-Toxics Substances Control Act [TSCA] and 2,900 cy of TSCA\(^1\) soil) will be excavated from the Upland Area, which will be backfilled to elevations ranging from approximately +20 (along the adjacent street right-of-way) to +14 ft MLLW (to the top of the bank). Cleanup passes triggered by the data described in the QAPP would increase the volume of excavated material. This QAPP is related to confirmation of completion of excavation, as well as confirmation of UST removal and treatment of contaminated contact water generated onsite.

The tasks to be completed to confirm excavation include:
- Fieldwork

\(^1\) Total PCBs exceed 50 mg/kg dw.
- Laboratory analyses
- Data management
- Data quality evaluation (validation)
- Data analysis and report preparation.

Section B describes tasks that will be completed in the field, including related documentation and QA/QC activities. The specific sequencing of the QA/QC tasks will depend upon the manner in which the Contractor stages the work. The Contractor’s plan for conducting this NTCRA will be documented in the RAWP.

**Fieldwork**
A Port consultant will collect soil and sediment samples and prepare them for delivery to the laboratory. The Field Manager will assume custody of samples as they are collected. Soil sample locations are shown in Figure A6-1. Samples will be analyzed by Analytical Resources Inc. (Tukwila, WA) for the analyte list is provided in Table A6-1. This table also includes reporting limits and analysis methods.

The Contractor will collect discharge water samples from the onsite water treatment plant, if such a plant is used. The Contractor may also collect the contact water and transport it to an offsite treatment facility. The discussion in this QAPP refers to the case in which the Contractor constructs and operates a temporary onsite water treatment plant to treat contaminated contact water. This water would be sampled before it’s discharged to the LDW. Field parameters will be measured onsite, and analytical samples will be delivered to a laboratory selected by the Contractor. Treatment plant discharge samples will be analyzed for PCBs and metals for comparison to water quality criteria (WAC173-201A-240). Two of the samples (one at the beginning of the project and one sometime in the middle of the work) will also be analyzed for TPH, cPAHs, dioxins/furans, and whole effluent toxicity for informational purposes.

A complete analyte list along with reporting limits and analysis methods is provided in Table A6-2. If the water is shipped offsite, any necessary monitoring will be determined by the treatment facility receiving the water. The remainder of this QAPP describes sampling of water discharged from an onsite system (but this is one option of two for contaminated water handling).

**Laboratory Analyses**
Analyses will be completed using EPA methods (EPA 2001, 2006), as indicated in Tables A6-1 and A6-2. Full laboratory data reports will be provided in portable document format (PDF), and electronic data deliverables (EDDs) will be provided in a text file format suitable for import into a database. Preliminary confirmation data (soil and sediment) will be provided to the QAO, as soon as possible, in electronic format. Excavation completeness decisions will be made using these preliminary (unvalidated) data.
**Data Management**

Soil and sediment data will be imported into the Port’s EMIS database, a working Excel file of the confirmation dataset will be prepared and managed by a Port consultant, for eventual import into an Access or EQUIS database originally constructed for the Engineering Evaluation/Cost Estimate (EE/CA; Windward et al. 2010). Database structure and maintenance are discussed in Section B10. Following receipt and validation of all confirmation data (after excavation), the Port will prepare spreadsheets of data representing remaining soil and sediment (i.e., data representing excavated soil and sediment will not be uploaded) for upload to Ecology’s Environmental Information Management system.

Discharge water data will be managed by the Contractor and will be used to evaluate the performance of the treatment system.

**Data Validation**

Data verification will be completed by the Quality Assurance Officer for data generated in the field, and data validation will be completed for the laboratory data after all final data packages are received.

The accuracy and completeness of the final soil and sediment databases will be verified by the Quality Assurance Officer. Data validation and data quality assessment will be completed by a Port consultant for soil and sediment data. The Contractor will be responsible for validation of water data. Data validation will include data verification (i.e., verifying that analytical procedures and calculations were completed correctly and checking transcriptions of the laboratory data) for the first data package for each analysis as part of the full validation that will be completed for these packages, as described in Section D.

Decisions regarding excavation completion will be made prior to full validation of soil and sediment. Treatment plant performance will also be evaluated prior to full data validation of water data.

**Data Analysis and Report Preparation**

Dredging and riverbank excavation will be confirmed by comparing each sample on a point-by-point basis to the sediment RvALs for total PCBs, arsenic, individual PAHs, cPAH, and phenol (indicator COCs). Dioxins/furans will be analyzed in 6 sediment samples: one in the nearshore row and one in the offshore row from each dredging unit (Table B2-4).

Upland Area soil data will be evaluated in accordance with the Model Toxics Control Act (MTCA) three-part rule. The rule includes point-by-point criteria that every sample must meet, as well as criteria that the entire dataset for each indicator COC must meet. Soil excavation will be confirmed by comparison to the soil RvALs for total PCBs, TPH, and cPAHs in all grid cells. Silver will be analyzed in 10 grid cells near/under the North Building. Completion will also be evaluated by comparison of dioxin/furan data collected from 6 of
the grid cells to the RvAL (11 ng TEQ/kg dw). Dioxin/furan and silver data were also generated in the pre-confirmation samples (9 samples), and these data will be part of the confirmation dataset. Arsenic will not be analyzed in soil confirmation samples.

Testing of the water treatment system discharge will be documented in Waste Testing Characterization Reports prepared by the Contractor.

Following excavation completion of each distinct area: Sediment Area, Upland Area, and riverbank, a Pre-Final Construction Completion Report will be prepared by a Port consultant. It will describe the confirmation sampling data (including any relevant statistics), any additional excavation passes (excavation completion decisions made using those data), the post-excavation topography data, and any deviations from the sampling plan.

A Removal Action Construction Report will be prepared by the Port within 30 days of the pre-certification inspection and after data have been validated. The QA/QC-related items in that report will include:

- Field procedures
- Any deviations from the approved plans
- Data summaries including appropriate statistical evaluations used to confirm excavation completions and achievement of RvALs
- Decisions regarding construction completeness (or the need for additional excavation) based on these data
- Final elevations to which excavations occurred, with a comparison to design elevations and a discussion of any additional passes completed
- Summary of water treatment performance and maintenance activities performed
- Data quality
- Tabulated field and laboratory data
- Discussion of database updates, including updates to a database field that identifies data associated with soil and sediment that have been removed.

A7 Quality Objectives and Criteria

The overall data quality objective for this project is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The QA procedures and measurements that will be used for this project are based on EPA and PSEP guidance (EPA 2001, 20022, 2006; PSEP 1986, 1997). Parameters related to precision, accuracy or bias, representativeness, completeness, and comparability (PARCC) are commonly used to assess the quality of environmental data (Tables A7-1 and A7-2).
A7.1 Precision

Precision is a measure of how closely one result matches another result expected to have the same value. Field precision is estimated by collecting one duplicate sample for every ten field samples from each unit (Upland Area, riverbank) and one duplicate from every ten water samples. If additional excavation passes are performed, such that new soil or bank sediment data are collected, 10% of the total number of samples collected for each sample type must have a field duplicate. Field precision is determined by the relative percent difference (RPD) between a parent sample and its duplicate.

Laboratory precision can be measured through the evaluation of laboratory control samples/duplicates (LCS/LCSD). The laboratory will perform the analysis of 1 set of LCS/LCSD samples for every 20 samples from each unit. Laboratory precision will be evaluated by the RPD between LCS/LCSD samples.

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

Where:
- R1 = Sample result
- R2 = Duplicate sample result

For calculation of RPD using field duplicates, sample and duplicate sample results used will be the calculated totals (total PCB Aroclors, cPAH TEQ, and TPH) as opposed to the individual constituents.

A7.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage of the true or reference value for reference material or as spike recovery from matrix spike/matrix spike duplicate (MS/MSD) samples. The RPD between the MS and MSD is used to evaluate laboratory precision. The following equations are used to express accuracy:

- For reference materials:
  - Percent of true value = \( \frac{\text{measured value}}{\text{true value}} \times 100 \)

- For spiked samples:
  - Percent recovery = \( \frac{\text{SQ} - \text{NQ}}{\text{S}} \times 100 \)
    - \( \text{SQ} \) = quantity of spike or surrogate found in sample
    - \( \text{NQ} \) = quantity found in native (unspiked) sample
    - \( \text{S} \) = quantity of spike or surrogate added to native sample

The performance of the method will be monitored using surrogate compounds. Surrogate standards are added to all samples, method blanks, matrix spikes, and calibration
standards. For the analysis of PCB Aroclors, decachlorinated biphenyl (DCB) surrogate will be added to all samples and standards. DCB will be analyzed as a point of reference and indicator of retention time shifts. Other surrogates are identified in Table A7-1.

Laboratory method reporting limits (MRL) are listed in Tables A6-1 and A6-2. All soil and sediment reporting limits are below the RvALs (Table B1-2). All water reporting limits are below the marine chronic water quality criteria (WAC 173-201A Table 240[3]).

A7.3 Representativeness

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

A7.4 Comparability

Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by EPA and PSEP and are commonly used for sediment and soil studies.

A7.5 Completeness

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

\[
\text{Completeness} = 100\% \times \frac{\text{number of valid measurements}}{\text{total number of measurements}}
\]

Completeness will be calculated for each sampling unit. For confirmation samples, the “total number of measurements” in the denominator of the above equation, is number of samples representing the post-excavation surface (as opposed to all samples collected, which would include that representing material removed by cleanup passes. The data quality objective (DQO) for completeness for all analytes from all post-excavation datasets, for the north building characterization samples, and for UST removal soil samples, and for discharge water treatment is 100%. Data that have been qualified as estimated (J qualified) will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected or that have a reporting limit greater than the respective RvAL will not be considered valid for the purpose of assessing completeness.

In the event of an elevated reporting limit in a sample that meets RvALs for the other COCs, the remaining solids at the laboratory (not consumed by the analysis) may be analyzed. Adjustments to the analytical procedures (e.g., extraction techniques) would be discussed...
with the laboratory to determine if this will help achieve lower reporting limits. If a sample with an elevated reporting limit was exceeding RvALs for other COCs, such that that area would be subject to a cleanup pass, that particular sample (at that shallower elevation) would not be recollected. A new sample collected after the cleanup pass would be collected (at the deeper elevation), and it would be a part of the confirmation dataset and would be used to evaluate completeness.

If data are rejected during the data validation process, additional sample collection would be problematic because the excavation and backfilling would have already occurred.

The sediment chemical and physical testing will adhere to the PSEP QA/QC procedures and analysis protocols (PSEP 1997).

**A7.6 Laboratory QC Procedures**

Additional laboratory QC procedures will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

QC samples and procedures are specified in each method protocol (Tables A6-1 and A6-2). All QC requirements will be completed by the laboratory as described in the protocols, including the following (as applicable to each analysis):

- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration
- Calibration or instrument blanks
- Method blanks
- LCS/LCSD
- Internal standards
- Surrogate spikes
- Serial dilutions
- MS/MSD.

**A8 Special Training and Certification**

Specific training requirements for performing field work, which may bring employees in contact with hazardous materials include:

- All field personnel assigned to the site must have successfully completed 40 hours of training for work (with current annual 8-hour refresher training) related to hazardous waste and emergency response (HAZWOPER) in accordance with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e). Documentation of OSHA training is required prior to personnel being permitted to work on site.
Personnel managing or supervising work on site will also have successfully completed 8 hours of manager/supervisor training meeting the OSHA requirements specified in 29 CFR1910.120(e)(4).

Personnel assigned to the site must be enrolled in a medical surveillance program meeting the requirements of 29 CFR 1910.120(f). Personnel must have successfully passed an occupational physical during the past 12 months and be medically cleared to work on a hazardous waste site and capable of wearing appropriate personal protective equipment.

Contractor staff directing the UST closure, removal and characterization must have a certification from the International Fire Code Institute.

Personnel performing the sampling work must have extensive knowledge, skill, and demonstrated experience in the execution of the sampling methods.

A9 Documents and Records

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

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

Copies of all field notes, field logs, sample collection logs, and field photographs will be sent to the Field Manager weekly. These materials will be reviewed by the Field Manager daily, if not more frequently, as the Field Manager and field staff will confer continuously over the sampling program. These items will be stored electronically with the project file.

At the completion of the removal action, a Removal Action Construction Report will be written by the Port. It will document the project activities, and specific to the CQAP, it will document confirmation sampling and water discharge monitoring methods and results. It will be based, in part on construction report provided by the Contractor to the Port. It will be submitted to EPA within 30 days of the pre-certification inspection.
### Table A4-1 Project Roles and Responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Person</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EPA Remedial Project Manager</strong></td>
<td>Piper Peterson</td>
<td>• Direct other EPA staff, USACE, and consultants to review and comment on materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordinate with public outreach staff to inform community on site activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Grant final approval on this QAPP, on data use, and on excavation prism.</td>
</tr>
<tr>
<td><strong>EPA QA Manager</strong></td>
<td>Ginna Grepo-Grove</td>
<td>• Review this QAPP, laboratory reports, and data validation report.</td>
</tr>
<tr>
<td><strong>USACE Technical Contractor to EPA</strong></td>
<td>Leanna Woods Pan</td>
<td>• Review confirmation data for compliance with cleanup goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Advise on sampling methodology.</td>
</tr>
<tr>
<td><strong>Subcontractor to USACE</strong></td>
<td>Greg Glass</td>
<td>• Advise on the confirmation sampling methodology and sample placement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Review data and statistics generated for compliance with cleanup goals.</td>
</tr>
<tr>
<td><strong>Port Consultant Project Manager</strong></td>
<td>To be determined</td>
<td>• Primary point of contact with EPA, the Port, and City</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitor all aspects of the project to verify that all work is being completed in accordance with this QAPP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Review all technical documents associated with the project for technical accuracy and feasibility.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide weekly construction and QA report to EPA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide information to the community relations team for community press releases/communication.</td>
</tr>
<tr>
<td><strong>Port Consultant Quality Assurance Officer</strong></td>
<td>To be determined</td>
<td>• Review laboratory analytical data as it’s received by rapid-turn around analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide the Data Validator with the laboratory analytical data and sampling field notes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Serve as liaison between the laboratory and Field Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure that the integrity of the samples and analyses are maintained at the laboratory.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide necessary documentation needed to support goals of the project</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintain a complete set of laboratory data, both preliminary data for decision making and final data to be included in the database and the Removal Action Construction Report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verifying that data reported are correct</td>
</tr>
<tr>
<td>Role</td>
<td>Person</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Port Consultant Field Manager | To be determined        | - Collect soil and sediment samples  
- Maintain a log (field log book) for all confirmation sampling-related activities  
- Coordinate the sampling operations to verify that this QAPP is followed  
- Identify any deviations from this QAPP  
- Prepare the field data and information for reports  
- Ensure that the integrity of the samples is maintained throughout sample collection and transport to the laboratory |
| Port Resident Engineer        | Stacy Heilgeist         | - Direct Contractor to conduct additional excavation or inform Contractor when excavation is complete.  
- Coordinate with Contractor to provide sampling team with safe access to excavation prism (i.e., determine when Contractor has completed an area and advise field staff to collect samples) |
| Port Environmental Compliance and Community Liaison | Dave Jenkins | - Monitor all aspects of the project to verify that all work is being completed in accordance with this QAPP  
- Review all technical documents associated with the project for technical accuracy and feasibility  
- Provide weekly construction QA report to EPA  
- Provide information to the community relations team for community press releases/communication. |
| Port Project Coordinator      | Roy Kuroiwa             | - Primary point of contact with EPA and the City. |
| Data Validator                | To be determined        | - Evaluate conformance of the analyses with the specifications of this QAPP  
- Verify the reported results with the raw data  
- Ensure the Electronic Data Deliverables match the analytical reports  
- Prepare validation report. |
<table>
<thead>
<tr>
<th>Role</th>
<th>Person</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| **Contractor Project Engineer and Quality Control Representative** | To be determined | • Review laboratory analytical data related to discharge monitoring  
• Serve as liaison between the laboratory and Superintendent  
• Ensuring that the integrity of the samples and analyses are maintained at the laboratory.  
• Provide necessary documentation needed to support goals of the project and ensure that laboratory meets project data quality objectives  
• Maintain a complete set of laboratory data, both preliminary data for decision making and final data to be included in the database and the Removal Action Construction Report  
• Verifying that data reported are correct.  
• Maintain a log (field log book) for all water discharge sampling-related activities  
• Coordinate the sampling operations and water treatment plant maintenance activities  
• Identify any deviations from this QAPP  
• Prepare the field data and information for reports  
• Ensure that the integrity of the samples is maintained throughout sample collection and transport to the laboratory  
• Submit daily reports to the Port. |
| **Laboratory staff** | To be determined | • Conduct analysis of soil, sediment, and water samples (may be different laboratories)  
• Conduct whole effluent toxicity testing  
• Practice quality assurance methods per internal laboratory standard operating procedures and document such practices  
• Verify quality of samples (e.g., cooler temperature) as they’re received at the laboratory  
• Provide preliminary confirmation data in an expedited manner, ensuring that transcription errors do not occur, as these data will be used to confirm excavation completion, i.e., they must be relied upon for decision making. |
Table A6-1 Analytes, Reporting Limits, Methods, and Sample Containers for Soil and Sediment Samples

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Analytical Method</th>
<th>MRL</th>
<th>MDL</th>
<th>Matrix Spike with Target Analyte?</th>
<th>Sample Container¹</th>
<th>Holding Time</th>
<th>Soil Removal Action Level</th>
<th>Sediment Removal Action Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic (mg/kg)</td>
<td>EPA 6010</td>
<td>5</td>
<td>0.0033</td>
<td>x</td>
<td>8-ounce glass</td>
<td>6 months</td>
<td>7.3</td>
<td>12</td>
</tr>
<tr>
<td>Silver (mg/kg)</td>
<td>0.3</td>
<td>0.00043</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>n/a</td>
</tr>
<tr>
<td>Total PCBs (µg/kg dw); RvAL is for the sum of detected Aroclors².</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1016</td>
<td>EPA 8082</td>
<td>4</td>
<td>0.577</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1221</td>
<td>4</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1232</td>
<td>4</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1242</td>
<td>4</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1248</td>
<td>4</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1254</td>
<td>4</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1260</td>
<td>4</td>
<td>0.61</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carcinogenic PAHs (µg/kg dw); RvAL is for a calculated TEQ³.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(a)anthracene</td>
<td>EPA 8270-SIM</td>
<td>5</td>
<td>1.6</td>
<td>x</td>
<td></td>
<td>14 days</td>
<td>140</td>
<td>90</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>5</td>
<td>0.65</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(b)fluoranthene</td>
<td>5</td>
<td>1.9</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td>5</td>
<td>2.05</td>
<td></td>
<td>Use benzo(b) fluoranthene</td>
<td></td>
<td>14 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chrysene</td>
<td>5</td>
<td>1.88</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dibenzo(a,h) anthracene</td>
<td>5</td>
<td>2.38</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeno(1,2,3-cd)pyrene</td>
<td>5</td>
<td>3.47</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Semivolatile Organic Compounds (µg/kg dw); COCs for sediment only; RvAL is the Sediment Quality Standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenol</td>
<td>EPA 8270-SIM</td>
<td>5</td>
<td>2.56</td>
<td>Same container as cPAHs</td>
<td></td>
<td>14 days</td>
<td>n/a</td>
<td>420 µg/kg dw</td>
</tr>
<tr>
<td>2-methylnaphthalene</td>
<td>5</td>
<td>1.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38 mg/kg oc</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>5</td>
<td>1.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 mg/kg oc</td>
</tr>
<tr>
<td>Anthracene</td>
<td>5</td>
<td>1.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>220 mg/kg oc</td>
</tr>
<tr>
<td>Dibenzofuran</td>
<td>5</td>
<td>1.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15 mg/kg oc</td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>5</td>
<td>1.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>160 mg/kg oc</td>
</tr>
<tr>
<td>Fluorene</td>
<td>5</td>
<td>1.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23 mg/kg oc</td>
</tr>
<tr>
<td>Analyte</td>
<td>Analytical Method</td>
<td>MRL</td>
<td>MDL</td>
<td>Matrix Spike with Target Analyte?</td>
<td>Sample Container(^1)</td>
<td>Holding Time</td>
<td>Soil Removal Action Level</td>
<td>Sediment Removal Action Level</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------------</td>
<td>-----</td>
<td>-----</td>
<td>----------------------------------</td>
<td>------------------------</td>
<td>--------------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td></td>
<td>5</td>
<td>1.98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 mg/kg oc</td>
</tr>
<tr>
<td><strong>Petroleum Hydrocarbons (mg/kg); RvAL is for the sum of detected hydrocarbon(^4).</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel range hydrocarbons</td>
<td>NWTPH-Dx</td>
<td>5</td>
<td>1.35</td>
<td>x</td>
<td>8-ounce glass</td>
<td>14 days</td>
<td>200 as diesel only</td>
<td>n/a</td>
</tr>
<tr>
<td>Lube oil range hydrocarbons</td>
<td></td>
<td>10</td>
<td>2.48</td>
<td></td>
<td></td>
<td></td>
<td>2,000 as sum of detected analytes</td>
<td></td>
</tr>
<tr>
<td><strong>Dioxins/Furans (ng/kg); RvAL is for a calculated TEQ(^5).</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,3,7,8-TCDD</td>
<td></td>
<td>1</td>
<td>0.274</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11 ng TEQ/kg</td>
</tr>
<tr>
<td>2,3,7,8-TCDF</td>
<td></td>
<td>1</td>
<td>0.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13 ng TEQ/kg</td>
</tr>
<tr>
<td>1,2,3,7,8-PeCDD</td>
<td></td>
<td>5</td>
<td>0.647</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1,2,3,7,8-PeCDF</td>
<td></td>
<td>5</td>
<td>0.832</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,3,4,7,8-PeCDF</td>
<td></td>
<td>5</td>
<td>1.076</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,2,3,4,7,8-HxCDD</td>
<td></td>
<td>5</td>
<td>0.481</td>
<td></td>
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</tr>
<tr>
<td>1,2,3,6,7,8-HxCDD</td>
<td></td>
<td>5</td>
<td>0.561</td>
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<tr>
<td>1,2,3,7,8,9-HxCDD</td>
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<td>5</td>
<td>0.886</td>
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</tr>
<tr>
<td>1,2,3,4,7,8-HxCDF</td>
<td></td>
<td>5</td>
<td>0.991</td>
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</tr>
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<td>1,2,3,6,7,8-HxCDF</td>
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<td>5</td>
<td>0.769</td>
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<td>2,3,4,6,7,8-HxCDF</td>
<td></td>
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<td>0.857</td>
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<td></td>
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</tr>
<tr>
<td>1,2,3,4,6,7,8-HpCDD</td>
<td></td>
<td>5</td>
<td>0.904</td>
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<tr>
<td>1,2,3,4,6,7,8-HpCDF</td>
<td></td>
<td>5</td>
<td>0.828</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OCDD</td>
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<td>OCDF</td>
<td></td>
<td>10</td>
<td>7.452</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BTEX (µg/kg dw); only analyzed in UST removal area</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>8270C - SIM</td>
<td>0.5</td>
<td>0.082</td>
<td>X</td>
<td>Methanol-preserved 40-ml VOA vial</td>
<td>14 days</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Toluene</td>
<td></td>
<td>0.5</td>
<td>0.137</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Ethylbenzene</td>
<td></td>
<td>0.5</td>
<td>0.104</td>
<td>X</td>
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</tr>
<tr>
<td>m,p-xylene</td>
<td></td>
<td>1</td>
<td>0.293</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>o- xylene</td>
<td></td>
<td>0.5</td>
<td>0.083</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Notes: 1. Minimum sample container sizes for each analysis are provided in this table; one 1-qt jar may be filled for all analyses. The laboratory will perform all drying and sieving on the soil from this one jar, as a whole. Soil will not be subsampled for the individual analyses until after drying and sieving have occurred. The sediment for each sample will be submitted in one jar.
2. Total PCBs is the sum of detected Aroclors. Spikes and MDLs are only maintained for Aroclors 1016 and 1260; however, all seven Aroclors will be quantified and reported.
3. cPAHs is a toxicity equivalent (TEQ) calculated using 2004 California EPA mammalian toxicity equivalency factors for the seven individual PAHs in this table.
4. TPH is the sum of detected diesel range and lube oil range hydrocarbons. Laboratory limits are on a wet weight basis.
5. Dioxins/furans will be evaluated as a TEQ using 2005 World Health Organization mammalian toxicity equivalency factors.
### Table A6-2 Analytes, Reporting Limits, Methods, and Sample Containers for Treated Discharge Water Samples

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Analytical Method</th>
<th>MRL (µg/L)</th>
<th>MDL (µg/L)</th>
<th>Sample Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field parameters; compare to criteria for marine “excellent” waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>Field meter</td>
<td></td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCB Aroclors (µg/L); total Aroclors compare to marine chronic water quality criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aroclor 1016</td>
<td>EPA 608</td>
<td>tbd by Contractor</td>
<td>Two 1-L amber glass</td>
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</tr>
<tr>
<td>Aroclor 1221</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Aroclor 1242</td>
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<tr>
<td>Aroclor 1248</td>
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<td></td>
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<tr>
<td>Aroclor 1254</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Aroclor 1260</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Aroclor 1262</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals (µg/L); compare to marine chronic water quality criteria</td>
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</tr>
<tr>
<td>Arsenic</td>
<td>EPA 200.8</td>
<td>tbd by Contractor</td>
<td>500 mL plastic; with HNO₃ preservative to pH &lt;2</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chromium</td>
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</tr>
<tr>
<td>Copper</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>EPA 245.7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
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<tr>
<td>Silver</td>
<td>EPA 200.8</td>
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<tr>
<td>Zinc</td>
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<td></td>
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<tr>
<td>Dioxins/Furans (pg/L); for informational purposes only</td>
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<tr>
<td>2,3,7,8-TCDD</td>
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<td></td>
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<tr>
<td>1,2,3,7,8-TeCDD</td>
<td></td>
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<tr>
<td>1,2,3,7,8-TeCDF</td>
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<tr>
<td>2,3,4,7,8-TeCDF</td>
<td></td>
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<td></td>
<td></td>
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<td>1,2,3,4,7,8-HxCDD</td>
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</tr>
<tr>
<td>1,2,3,6,7,8-HxCDD</td>
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<td></td>
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</tr>
<tr>
<td>1,2,3,7,8,9-HxCDD</td>
<td></td>
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</tr>
<tr>
<td>1,2,3,4,7,8-HxCDF</td>
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<td></td>
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<tr>
<td>1,2,3,6,7,8-HxCDF</td>
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<td>1,2,3,7,8,9-HxCDF</td>
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<td>1,2,3,4,7,8-HpCDF</td>
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<tr>
<td>1,2,3,4,6,7,8-HpCDF</td>
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<tr>
<td>1,2,3,4,6,7,8-HpCDF</td>
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<td></td>
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</tr>
<tr>
<td>OCDD</td>
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</tr>
<tr>
<td>OCDF</td>
<td></td>
<td></td>
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</tbody>
</table>

*EPA 608* designates that the methods are traceable to either the Advanced Monitoring and Reporting System (AMRS) Method 608 or EPA 608A. (Note: AMRS Method 608A has been replaced by Method 608, which is now the traceable method.)
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Analytical Method</th>
<th>MRL (µg/L)</th>
<th>MDL (µg/L)</th>
<th>Sample Container</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cPAHs (µg/L); for informational purposes only</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Benzo(a)anthracene</td>
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</tr>
<tr>
<td>Benzo(a)pyrene</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(b)fluoranthene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chrysene</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dibeno(a,h) anthracene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeno(1,2,3-cd)pyrene</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Petroleum Hydrocarbons (mg/L); for informational purposes only</strong></td>
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<tr>
<td>Diesel range hydrocarbons</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lube oil range hydrocarbons</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Whole Effluent Toxicity</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Chronic toxicity on marine organisms</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Analytical Method</th>
<th>MRL (µg/L)</th>
<th>MDL (µg/L)</th>
<th>Sample Container</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

tbd – to be determined.
### Table A7-1 Soil and Sediment Measurement Quality Objectives

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
<th>Precision (RPD; lab/field)</th>
<th>Accuracy</th>
<th>Completeness</th>
<th>Preservation/Storage</th>
<th>Surrogate Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB Aroclors</td>
<td>EPA 8082</td>
<td>35%/50%</td>
<td>70-130%</td>
<td>100%</td>
<td>Cool/4°C</td>
<td>decachlorobiphenyl</td>
</tr>
<tr>
<td>Petroleum Hydrocarbons</td>
<td>NWTPH-Dx</td>
<td>70-130%</td>
<td>100%</td>
<td></td>
<td></td>
<td>O-terphenyl</td>
</tr>
<tr>
<td>PAHs</td>
<td>EPA 8270D-SIM¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>d10-2-methylnaphthalene, d14-dibenzo (a,h)anthracene</td>
</tr>
<tr>
<td>Arsenic and Silver</td>
<td>EPA 6010B²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Dioxins/Furans</td>
<td>EPA 1613</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labeled surrogates of all analytes in Table A6-1</td>
</tr>
</tbody>
</table>

Note: RPD = relative percent difference must be 35% of lower in laboratory MS/MSD and LCS/LCSD pairs and 50% or lower in parent/field duplicate pairs.

1. Method 6010B quantifies several metals, but only silver will be reported in soil, and only arsenic will be reported in sediment.
2. PCB Aroclors include: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The RvAL will be compared to total PCBs (sum of detected Aroclors).
3. Seventeen dioxin/furan congeners will be reported. Homolog group totals for dioxins and for furans with four to seven chlorine atoms will also be reported by the laboratory (i.e., total tetra-, penta-, hexa-, and hepta-chlorinated furans and total tetra-, penta-, hexa-, and hepta-chlorinated dioxins). TEQs will be compared to the RvALs.

### Table A7-2 Treated Discharge Water Measurement Quality Objectives

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
<th>Precision (RPD)</th>
<th>Accuracy</th>
<th>Completeness</th>
<th>Preservation/Storage</th>
<th>Control must not show effects; metrics related to organism health, dilution/control water used, and aquarium operation must be met.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB Aroclors</td>
<td>EPA 8082</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td>EPA 3050 and</td>
<td>50%</td>
<td>70-130%</td>
<td>100%</td>
<td>Dark, 4°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1631</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>PAHs</td>
<td>EPA 82709-SIM</td>
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<tr>
<td>Petroleum hydrocarbons</td>
<td>NWTPH-Dx</td>
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</tr>
<tr>
<td>Dioxins/Furans</td>
<td>EPA 1613</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole Effluent Toxicity</td>
<td>EPA 2002 guidance</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
B. Data Generation and Acquisition

B1 Sampling Process Design

The sampling program addressed in this QAPP is to:

- Confirm completion of excavation (B1.1 through B1.3). Post-extraction confirmation data (for indicator COCs) will be used to confirm the completeness of excavation within the three distinct units summarized in Table B1-1.
- Evaluate sediment perimeter chemical quality before and after dredging (B1.4)
- Characterize soil under the North Building (B1.5)
- Close and remove a heating oil UST and any impacted soil (B1.6)
- Monitor the quality of treated discharge water (B1.7).

Confirmation data will be used to determine whether excavation is complete or additional excavation is required. Sample locations are shown on Figure A6-1. Table B1-1 defines the sample collection and RvAL evaluation methodology for each sampling unit. Table B1-2 lists the RvALs for each COC for each media.

Soil and sediment samples will be analyzed for parameters as shown in Table B1-2. Field duplicate samples and equipment rinse blanks will be collected at a frequency of 10 and 5 percent, respectively, of samples.

B1.1 Soil Confirmation Sampling Design

The primary objective of the soil sampling described in this QAPP is to collect data that are needed to assess post-extraction conditions in the T-117 Upland Area. Data will be collected from the bottom of excavations after the Contractor has completed excavation to the design elevations and a topographic survey has confirmed that design elevations have been reached. A visual scan of the excavation bottom to be sampled will be conducted before samples are collected. Any obvious contamination/oils will trigger the need for additional excavation prior to sample collection.

One soil confirmation sample will be collected from the bottom of each grid cell. A grid of approximately 2,500-square foot (sq ft) cells was overlaid on the entire Upland Area, such that it covers both excavated areas and those designated for no excavation in the Final Design Report (hatched areas in Figure A6-1). Each sample will be a three-point composite collected from within its grid cell. These data will be compared to the soil RvALs in Table B1-2. Excavation in 9 of the grid cells will extend below the groundwater table, such that post-confirmation sample quality would be inadequate. Therefore, these grid cells were pre-confirmed in 2012 by data from subsurface borings. The data from this event is part of the dataset used to confirm excavation completion.

Samples will be collected following excavation of a grid cell after it has been confirmed by the Contractor that design elevations have been achieved. A topographic survey will be
conducted to verify that the excavation has met design elevations. No confirmation samples will be collected prior to collection and processing of this information.

Each sample will be analyzed on an expedited turn-around basis in order to confirm excavation completion in a timely manner. No backfilling of a grid cell may begin until these data have been received and evaluated. They will be used to determine if and where additional excavation passes are needed. Decisions regarding the completeness of excavation will be made prior to data validation. The sequence of sample collection will be guided by the manner in which the Contractor stages the site work.

**Comparison to Removal Action Levels**

Each grid cell composite will be made by collecting surface soil (0 to 0.5 ft) from three locations in the bottom of the excavation. All samples will be compared to the lowest soil RvALs (for depth-dependent RvALs) for total PCBs, cPAHs, and, TPH (Table B1-1) using the MTCA three-part rule defined in Washington Administrative Code (WAC) 173-340-740(7):

- No sample may exceed two times the soil RvAL for any COC. Further excavation is required in the grid cell containing this sample.
- No more than 10% of the samples may exceed a soil RvAL.
- The 95% upper confidence limit (UCL) on the population mean (as calculated by ProUCL 4.1 for each COC) may not exceed the soil RvAL.

A subset of grid cells will also be analyzed for silver (ten grid cells identified in Table B2-2) and dioxins/furans (six grid cells, described below). The data from the nine pre-confirmation grid cells will be included in the datasets used to confirm excavation completion for all soil COCs. Treatment of undetected data and generation of calculated totals (TEQs, total PCBs) follow Lower Duwamish Waterway Remedial Investigation and T-117 EE/CA data management rules. However, when datasets have a low detection frequency, the treatment of undetected data can have a strong influence on the evaluation of compliance with the three-part rule. This will be a part of the risk management decision-making related to excavation completion confirmation.

An exceedance of any of these criteria triggers additional excavation (1-ft depth) in a grid cell(s) and the collection of a new post-excitation surface sample from that grid cell(s) (one new three-part composite sample). Because two of the criteria are based on an evaluation of the entire confirmation dataset, risk management decisions related to excavation completion and backfilling may be made as excavation advances across the Upland Area, if the Contractor needs to backfill certain grid cells. Where additional excavation is performed, new data will be collected from those grid cells. These new data will replace the data representing the excavated soil, and the population statistics for each indicator COC will be re-evaluated, such that the confirmation dataset evaluate for each indicator COC represents the excavated surface. The data collected from the Final Design elevations during the pre-confirmation sampling event (nine grid cells) in 2012 are a part of the confirmation dataset.
Confirmation sample analyses for dioxins/furans shall focus on areas between the north and south buildings, over the entire nearshore/inland dimensions of that part of the Upland Area, and omitting grid cells where pre-excavation confirmation sampling has already occurred (nine samples, already part of the confirmation dataset). The designated dioxin/furan sampling area shall be subdivided into three approximately equal segments, north to south, following grid cell boundaries. Two grid cells in each of these three subareas shall have dioxin/furan analyses included in confirmation samples, for a total of six samples in the post-excavation dataset evaluated for dioxins/furans. Criteria for selection of grid cells for which dioxin/furan analyses will be performed shall include:

- At least 1 of the 6 grid cells selected shall be a grid cell where no excavations to meet RVAls are planned.
- The 2 selected grid cells in each subarea (and grid cells across subarea boundaries) shall not be adjacent or contiguous, to provide some degree of spatial coverage.
- The 2 selected grid cells in each subarea shall reflect different excavation elevations (minimum 3-ft difference).
- At least 2 of the 6 selected grid cells shall be locations where maximum total PCB concentrations (any depth, individual samples) were at least 100 mg/kg dw, that is 2 of the grid cells shall overlap TSCA removal areas.

In the event all of these criteria cannot be met, EPA will be consulted to review the selection of grid cells for additional dioxin/furan analyses. The selections of grid cells will also be largely based on Contractor sequencing because these grid cells must remain open for at least one week while samples are being analyzed.

Professional judgment and discussion with EPA will determine the prisms to be excavated further. It is unlikely that the entire Upland Area will be excavated at one time. It is anticipated that the Contractor will excavate a particular portion of the Upland Area and backfill it before other areas are excavated. Because the entire Upland Area will not be open for additional excavation when the entire dataset is generated, conservative decisions will be made as the excavation proceeds, such that there is a very high likelihood that the dataset (for each soil COC) will meet the three-part rule.

Sidewall samples will not be collected around the Upland Area boundary. With the exception of a small area of soil excavation (to 1.5 ft below ground surface) on the adjacent Boeing property, the soil excavation will not extend beyond the Upland Area. This small area is in Grid Cell RR.

**B1.2 Riverbank Confirmation Sampling Design**

Sediment data will be collected across the face of the excavated (using land-based equipment) north and south areas of the riverbank (outside of the sheet pile wall
enclosure) when the tide is below the sample collection locations. Each riverbank area is divided into three units, coincident with the adjacent upland excavation prisms. Within each unit, a 6-part composite sample will be collected along two transects lying up/down the bank face. These data will be compared to the sediment RvALs in Table B1-2. Sample collection locations are shown on Figure B1-1.

The post-excitation surface of both the north and south areas of the bank will be sloped. Conversely, the middle portion of the riverbank will be excavated to 0 ft MLLW within the Sediment Area and to higher elevations in the Upland Area, such that there will not be a sloped bank face.

Riverbank samples are six-part composites, with each sample being compared to the sediment RvALs (Figure B1-1). If data exceed any RvAL, additional excavation of the entire unit (1-ft cut into the bank face) will occur. New confirmation samples will be collected after this excavation pass is completed, and they will be analyzed for the indicator soil COCs, and compared to the soil RvALs. Each new sample is a six-part composite that may not exceed any indicator soil RvAL.

Sediment will be vacuumed from rip rap voids along a small portion of the riverbank on the South Park Marina property (to the north of T-117). No sampling will be conducted after this activity. No material suitable for sampling will remain, i.e., only rip rap will remain.

B1.3 Sediment Confirmation Sampling Design

Fourteen surface sediment samples arranged in two rows will be collected from three dredging units after dredging and bathymetric survey confirmation of target elevation achievement. Each sediment sample will compared to the sediment RvALs on a point-by-point basis. All samples are required to be below the sediment RvALs. Dioxins/furans will be analyzed in six samples: one nearshore and one offshore from each of the three dredging units (Table B2-4).

Within each of the three dredging units (potentially to be adjusted by Contractor’s Dredging Plan2), an exceedance in any sample will result in a cleanup dredging pass of the entire half/row of the dredging unit from which that sample was collected, regardless of the results of the other samples in the row of that unit. This is meant to address heterogeneity in COC distribution within the in situ sediment and within the anticipated dredging residuals. Further, any offshore row exceedances of the Washington State Sediment Management Standards Cleanup Screening Level (CSL) or 5-times any RvAL would result in a cleanup dredging pass of the entire dredging unit. After each cleanup pass, new confirmation samples will be collected in the entire re-dredged area from the same locations as those sampled initially (not only from those location that exceeded RvALs).

2 If the Contractor’s Dredging Plan substantially changes the dredging unit layout, EPA shall be consulted for potential revisions to the sediment confirmation sampling design.
B1.4 Sediment Perimeter Sampling

Although appropriate BMPs will be used during dredging and all other in-water activities, there is a potential for residuals to contaminate surface sediment outside of the Sediment Area. Additionally, dredging of contaminated sediments will occur across the LDW from T-117 in the Boeing Plant 2/Jorgensen Forge Early Action Area.

Sediment samples will be collected along the perimeter of the Sediment Area, both before dredging and after backfill placement. These data will be used to assess potential changes in sediment quality associated with remedial activities in T-117 and in other nearby cleanup areas. Surface sediment (0-10 cm) samples from 5 locations 50 to 75 ft from the Sediment Area boundary (Figure B1-2) will be analyzed for the sediment COCs and the Sediment Management Standard (SMS) chemicals. The results will be documented in the Removal Action Construction Report and will not be used to trigger additional action.

B1.5 North Building Evaluation

Soil under the North Building has not been characterized because the condition of the building has prevented safe entry. Four confirmation grid cells overlap the building footprint. The three northern grid cells (G, H, I) underlie a warehouse portion of the building that has been identified in all historical photographs taken during industrial site use. The southern grid cell (J) is under a dock area that was constructed later. Grid Cell J also overlaps a septic drain field, and is near a historic roadway and near an area excavated during the 2006 TCRA. Silver is of concern in the septic system, due to historical activities in the North Building that may have released silver-containing fluids down the building drains.

After this building is demolished (or deconstructed for reuse of materials), one soil boring will be completed in each of the three northern grid cells (G, H, I) and three soil borings will be collected from Grid Cell J (Figure B1-3). Note that grid cells are used for post-excavation confirmation and not for pre-excavation characterization. They are identified for map reference purposes only here. However, four grid cells were drawn to cover the North Building and adjacent “no excavation” areas, such that confirmation composite samples would combine soil from areas having similar historical land uses. This initial investigation is independent from the later post-excavation confirmation sampling.

One-foot soil samples will be collected 0, 1, 2, 3, 5, 7 and 10 ft bgs. In all borings, the shallowest sample will be analyzed initially, and all others will be archived. Soil will be analyzed for TPH, PCBs, CPAsHs, and silver in all borings. Any RvAL exceedances will cause the next deepest sample to be analyzed. Dioxins/furans will be analyzed in the deepest sample analyzed in each boring; therefore, the sample to be analyzed for dioxins/furans won’t be known for each boring until data for the other COCs are generated (because the
other COC comparisons to RvALs determine which samples are analyzed and which remain archived).

If RvAL exceedances are identified, soil will be excavated below these exceedances, to the top of the passing sample. The lateral boundaries of the excavations, if excavation is necessary, will match the grid cell boundaries from which the boring was collected. In the southern grid cell, where three borings are to be collected, an excavation driven by any boring will cover a 1/3 area of the grid cell containing the boring.

**B1.6 Heating Oil UST Removal**

A suspected heating oil UST is located below the North Building. After building demolition, this UST must be emptied of fluids, decommissioned, and removed by Contractor personnel with a certification from the International Fire Code Institute. UST excavation sideline and bottom soil must be analyzed for TPH and BTEX. A subconsultant to the Port will conduct this sampling, and the Contractor will excavate any soil that exceeds applicable criteria.

After all excavation is completed in the North Building grid cells, due to the UST removal and due to any RvAL exceedances in the six borings, confirmation samples will be collected from the surface of the four grid cells (G, H, I, J) in the former building footprint. The locations for each 3-part composite sample are shown on Figure A6-1a.

**B1.7 Treatment Discharge Water Sampling Design**

The primary objective of discharge water sampling is to collect data to ensure sufficient operation of the water treatment system. These data will guide maintenance/ adjustments to the treatment system. Initial system testing when the system is being constructed, to ensure proper set up, is not discussed in this QAPP. The Contractor will design, operate, and maintain a water treatment plant that will handle water in contact with contaminated soil, including:

- Groundwater pumped from deep excavations and from within the sheet pile wall
- Stormwater in contact with contaminated soil
- Water used to decontaminate shoring and equipment
- Water that drains via gravity from wet stockpiled soil; this water will be collected within a bermed, lined stockpile area.

Water will be treated for discharge to the LDW, such that it meets the marine chronic criteria in WAC 173-201A-240, and such that field parameters meet those for marine waters of Excellent Quality as defined in WAC 173-201A-210. Table B1-3 lists the collection frequency and criteria for samples collected from the treatment plant effluent. Laboratory analysis of PCBs, PAHs, petroleum hydrocarbons, dioxins/furans, metals, and whole effluent toxicity will be conducted, and field measurements will be taken for conventional
parameters (turbidity, dissolved oxygen, pH, and temperature). Additionally, water will be visually observed for oil and floatable material.

**B2 Sampling Methods**

**B2.1 Upland Area Soil and Riverbank Sediment Confirmation Sample Collection**

Each sample will be visually classified, and the following information will be recorded:

- Elevation of sample collection
- Physical soil description (soil type and color, stratification)
- Other distinguishing characteristics or features
- The moisture content (approximate)
- For bank sediment, the tide level relative to the sample collection location.

Upland Area soil and riverbank sediment samples will be three-part composites. Surface soil/sediment to a 0.5-ft depth from each composite location will be spooned into a stainless steel bowl. An equal volume of material (10 ounces = 1 ¼ cup) will be collected from each location. The 30 ounces of soil/sediment within the bowl will be transferred to a 1-qt (32-ounce) laboratory-supplied container, as described in Section B2.6. Each container will be placed in a cooler and delivered to the laboratory as early in the day as possible (for rapid turn-around analysis) for the analyses listed in Table B1-2. Soil descriptions, field screening readings (e.g., photo-ionization detector), and other observations during installation will be recorded in the field on a sample collection form.

No-excavation areas may be used for soil stockpiling. Following stockpile removal, the area will be scraped; any remaining asphalt or concrete would be removed first. The area will then be sampled in the same manner as the excavation bottoms, to confirm that the stockpiles did not contaminate the underlying soil. These data will be included in the Upland Area soil dataset for comparison to the MITCA three-part rule.

**B2.2 Sediment Confirmation Sample Collection**

At each sediment sampling station, a single grab will be collected for chemical and physical analyses. A van Veen sediment sampler will be deployed from the sampling vessel using a hydraulic winch. The grab will be deployed and retrieved at a rate of approximately 1 ft/sec to minimize contacting the bottom at an angle and potential disturbance of the sediment surface within the sampler. Each van Veen gear deployment event will be recorded on a sample collection form. One or more sample collection forms will be completed for each station sampled. The station name, date, gear, cast number, water depth, mudline elevation (from the onboard basemap generated by the post-dredging bathymetric survey) and location coordinates will be recorded on each form.
Following the retrieval of the grab, it will be braced in an upright position using wooden blocks. The flaps will be opened and, if the material is judged to be acceptable for chemical analyses, the overlying water will be siphoned off. A photograph will be taken, and the upper 10 cm of material will be transferred to a stainless steel bowl.

If excessive water leakage is indicated by the lack of an overlying water layer, or if overlying water contains suspended particulate material (i.e., high turbidity), the sample will be rejected. The Field Manager will evaluate all samples collected. If a sample fails to meet the following criteria, it will be rejected and discarded away from the station:

- The sampler is not overfilled (i.e., sediment is not leaking through flaps).
- Overlying water is present and is not excessively turbid.
- The sediment surface is relatively undisturbed (i.e., minimal winnowing).
- A sediment penetration depth of at least 11 cm is attained.

Corrective actions that may be used in the field to address constant overfilling or under-penetration of the grab include removal of weights from the grab sampler or adding weights or buoys to the sampler. If samples to a depth of 10 cm cannot be obtained after repeated attempts, the field crew will accept a shallower penetration depth. Once a grab is deemed acceptable, the following field observations will be recorded on a field record form:

- The time elapsed since dredging was completed and the identification of any residual materials
- Sediment penetration depth (nearest cm) based on sediment depth at the center of grab
- Physical characteristics of the sediment surface, including color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, oil sheens, and odors
- Each sediment sample will be visually classified in general accordance with ASTM D 2487 (Classification of Soils for Engineering Purposes).

Sediment will be removed to a depth of 10 cm from both sides of the double van Veen grab using decontaminated, stainless-steel spoons. A stainless-steel ruler will be used to ensure that the sampling criterion for adequate penetration depth is met and that the correct amount (i.e., 10 cm) of sediment has been removed. The sediment will be placed into a decontaminated, stainless-steel bowl and homogenized using a stainless-steel spoon until the sediment attains a uniform color and texture. Care will be taken to ensure that sediment in contact with the walls of the van Veen, as well as any large items or debris, are excluded from the sample.

Sediment will be transferred to 1-quart glass jars, labeled, and placed in a cooler for transport to the laboratory.
B2.3 Upland Area Positioning

For all samples, the horizontal and vertical datums will be Washington State Plane North (North American Datum of 1983 [NAD 83]) and ft MLLW, respectively.

The soil excavation prisms are based on historical subsurface data and adjusted to fit within a network of approximately sized 2,500-sq ft grid cells. One 3-part composite sample will be collected from within each grid. Table B2-1 describes each grid cell, and Table B2-2 provides coordinates for the three composite locations forming each sample within each grid cell.

The objective of the sampling location placement methodology is to provide an equal probability of sampling from any location within a grid cell, such that soil representing the post-excavation surface of the grid cell is adequately evaluated, while avoiding the clustering of samples that can occur when pure random sampling is conducted. Therefore, the locations were selected through a modified random approach by which a baseline for each grid cell was established and split into equal thirds. A transect, which is a line drawn across the grid cell perpendicular to the baseline, was placed in each one-third portion of each grid cell. One sample location (location of soil used in one composite sample for each grid cell) was then randomly placed on each transect.

So that every location within a grid cell has an equal probability of being sampled, by falling on a transect, baselines were located such that an infinite number of lines perpendicular to the baseline (transects) would overlap any location in the grid cell one time. Because the grid cells are not all rectangular, the baseline (a perimeter of a grid cell) is unique to each grid cell, depending upon the grid cell’s geometry. It was usually on the longest grid cell side. In some instances, it was made from unconnected lines (when the grid cell side used for baseline contained jogs) or contained a bend. Table B2-1 contains the baseline and transect details.

To locate sampling location, random numbers between 0 and 1 were generated in Excel. The baseline length of each grid cell was divided by three (i.e., cell was split into thirds), and a random number was multiplied by that one-third length. The product (random * 1/3 baseline) represents the distance along the baseline from the starting corner of the grid cell (starting corner is identified in Table B2-1 for each grid cell) for positioning the first (A) sample location’s transect. The baseline position of the second (B) and third (C) sampling transects were set to a distance equal to one-third of the baseline length from the A location’s baseline position. At these three locations along the baseline, a line perpendicular to the baseline was drawn (transect) across the grid cell. Table B2-1 also lists the direction each transect extend from the baseline. (Note: they were not actually drawn on a figure, but were used in CAD to find the sampling coordinates.) Table B2-2 provides random numbers used to locate the transects, and their distances along the baseline.

Then, a location was found on each transect by multiplying a random number by the transect length at that location along the baseline. Because many of the grid cells are not
rectangular, the transect lengths vary by baseline position. Table B2-2 provides each transect length, the random number used, the position of each sampling location along the transects, and the coordinates of each sampling location.

For grid cells that require cleanup passes, new three-part composite samples will be collected from the bottom of that deeper excavation. The methods described above will be used to generate the new locations, but they will differ from the original locations because different random numbers will be used.

**B2.4 Riverbank Positioning**

The riverbank grab locations were identified in a similar manner. The distinction is that each riverbank unit has a six-part composite sample. Sediment will be collected from three locations on each bank transect, and sediment from two transects will be combined into a composite sample representing that riverbank unit. There are three units in the north bank area and three in the south bank area: North A, North B, North C, South A, South B, South C (Table B2-3).

In both the northern and southern riverbank areas three units were defined, coincident with adjacent upland excavation prisms. Each unit was then split in half, and a transect was placed in each half of each unit as follows. A random number multiplied by one-half of the length of the unit provided the distance from the northern or southern property boundary to the first (1) transect. The second transect (2) was sited one-half of the bank unit length from the first transect. The same process was repeated for each unit, with measurements being from the northern or southern edge of the unit. A new random number generated the location of the first transect in each unit.

Along each transect, the distance from the toe of the excavation (+2ft MLLW) to the top of the sloped bank was determined, as both the plan view distance observed on a map and as the transect distance that will be observed in the field on the sloped riverbank face. The transect distance was divided by three. A random number was multiplied by this one-third length and represents the distance up from the toe (+2ft MLLW) where the first grab will be collected. The other two grab locations in each transect are one-third the transect length up the bank slope from the first location. In each unit, soil will be collected from three locations on each of two transects and composited into one six-part composite sample in the field. Table B2-3 provides the bank sampling locations and their coordinates.

If a sample exceeds a sediment RvAL, additional excavation of the riverbank unit from which that sample was collected will be conducted. After the cleanup pass a new 6-part composite will be collected from that unit. The methods described above will be used to generate the new locations, but they will differ from the original locations because different random numbers will be used.

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3 For the northern unit, all measurements for placing the transects are from the northern property boundary to the south. For the southern unit, the measurements use the southern property boundary as the starting point.
Coordinates were identified using Computer Aided Drafting (CAD). After excavation of a particular area (bank or set of grid cells), as sequenced by the Contractor, a licensed professional surveyor will locate each sample location in the field using the coordinates determined by CAD. All locations will be clearly marked using paint or stakes on the excavated soil surfaces, after topographic surveys indicate achievement of design elevations. Riverbank samples must be collected prior to tidal inundation of the excavated face, and providing ample time for the Contractor to cover the face with an erosion cloth before tidal inundation.

**B2.5 Sediment Area Positioning**

Confirmation sediment sampling locations (Table B2-4) were determined through conversations with EPA and direction from EPA. Fourteen surface sediment samples will be collected from the post-dredge surface after a bathymetric survey confirms that design elevations are met. Sampling locations are set along two rows with seven in a nearshore row and seven in an offshore row. The north-south (upstream-downstream) location of the first nearshore row sample (northernmost) was set as a random number multiplied by one-seventh of the shoreline distance. The north-south locations of the other six nearshore samples were set at one-seventh of the shoreline distance upstream/south of the first sample. The distance offshore of each nearshore sample is one-fourth the distance from the shoreline to the outer edge of the dredging area at each location (Table B2-4).

The offshore row is staggered relative to the nearshore row such that the northernmost sample is situated at a north-south midpoint between the first nearshore row and the downstream end of the dredging area. Each of the other six offshore samples is spaced equally (one-seventh of dredging area length) from the first sample. The distance offshore of the offshore row of samples is ¼ the length from the shoreline to the edge of the dredging area.

Perimeter sediment sample locations (Table B2-5) selected to characterize chemical quality of sediment outside of the dredging footprint before and after dredging. They were positioned 50 to 75 feet from sediment being dredged so that they characterize any dredge residuals that migrate away from the Sediment Area, but so they’re not heavily influenced by dredging occurring in other areas of the LDW.

Sampling locations will be identified using a Trimble NT300D differential global positioning system (DGPS), or similar. The DGPS includes a GPS receiver unit onboard the sampling vessel and a Coast Guard beacon differential receiver. The GPS unit will receive radio broadcasts of GPS signals from satellites. The Coast Guard beacon receiver will acquire corrections to the GPS signals to produce positioning accuracy within 1 to 2 meters.

Vessel position coordinates will be updated every second and displayed directly on an on-board computer. The coordinates will then be processed in real time and stored at the time of sampling using the positioning data management software package HYPACK®, or similar.
Surface sediment elevation at the location of sample collection will be determined by two methods:

- Vertical control will be provided by the ship’s depth finder and corrected for tidal influence. Actual recorded tide elevation will be determined by querying actual recorded data (vs. predicted levels) from the Elliott Bay tide gage (#92) located at Pier 54 and adjusting levels for the Sediment Area location upstream in the LDW.
- Sample elevation will also be determined by locating the sample on a basemap containing the post-dredging survey elevations (contours or grid). Confirmation sampling does not occur until after a bathymetric survey has determined that design elevations were reached.

The elevations determined through these two methods must have a RPD of 10% or less. If the RPD is greater than 10%, the data associated with these two methods will be reviewed in closer detail, as an error in either may have ramifications for other project components.

To ensure the accuracy of the navigation system, monuments established for the dredging operations will be used to calibrate the navigation equipment. Section 01722 - Surveying describes monuments that will be installed by the Port for the Contractor to use to calibrate navigation equipment used for dredging, sheetpile wall installation, and other in-water activities. Similarly, monuments will be established along Dallas Ave S for Upland Area work. At the beginning and end of each day, the vessel will be stationed at the check point, a GPS reading will be taken, and the reading will be compared with the benchmark’s coordinates. The two position readings should be within 2 meters for both the x and y reading.

An on-board computer will display the vessel’s position and the proposed sample location coordinates during sampling operations. Each sample location will be displayed on the area map (containing basemap features such as the post-dredging bathymetric survey, the location of the sheetpile wall, and the South Park Marina remaining docks) on the computer screen, and the vessel’s location will be displayed as a moving dot on that map. The range and bearing from the vessel to the proposed station location (target position) will be displayed on the screen. The scale of the grid will be magnified as the vessel nears the proposed station location. During sampling, vessel position can be monitored constantly using this computer display. Actual sample location coordinates will be determined when the sampler contacts the sediment bed, and the cable is taut and perpendicular to the water surface. This actual location will be recorded. The actual location of each sample collection attempt will be recorded in the field log. When the collection attempt is acceptable (i.e., the jaws close tightly, the device is sufficiently filled with undisturbed sediment), the recorded coordinates will accompany the sample data in the database.
B2.6 North Building Characterization Methods

Soil borings completed after building removal will characterize soil under the North Building. One boring is located in the center of each of the three northern grid cells, and three borings are evenly spaced in the southern grid cell (Table B2-6). Subsurface soil will be collected using a GeoProbe advanced to 15 ft bgs. All soil collected within the GeoProbe sleeves will be visually characterized, and these observations will be recorded on a boring log. Soil will be collected from 1-ft intervals into 16-ounce jars at the following depths: 2, 5, 7, and 10 ft bgs. If any visual contamination is identified below 10 ft bgs, soil deeper intervals will be archived.

Soil will be analyzed for all soil COCs, and the grid cell (or one-third of the grid cell for the southern grid cell with three borings) will be excavated to the top of the sample below all RvALs.

The UST closure, decommissioning, and removal will be conducted by the Contractor, and the details of that work will be included in the Demolition Plan, as described in specification Section 02220.

B2.7 Discharge Water Sampling Methods

A grab sample will be collected from the water treatment system (discharge point) weekly. Samples will be analyzed for field parameters daily using hand-help equipment, which will provide immediate feedback. Laboratory samples analyzed for metals and PCBs will be compared to marine chronic criteria, which set limits that may not be exceeded in any 24-hour average of data collected for total PCBs, or in any 4-day average for metals. Because the water being sampled has been treated, an average will not be calculated (because only one sample will be collected weekly). Any sample exceeding the criteria in Table B1-3 (field or analytical) constitutes a performance criteria failure and signals the need for corrective action.

Water samples for PCB Aroclors will be collected from three locations within the water treatment plant weekly: up- and down-pipe from the first granular activated carbon filter (assuming two in series) and from the effluent. A comparison of PCB concentrations between in the water flow before and after the filter would indicate breakthrough from the filter and signals the need to replace that filter.

Two samples of the effluent will be analyzed for PAHs, TPH, dioxins/furans, and whole effluent toxicity for informational purposes (once at the start of the work, and once around the middle of the project).

In addition to chemical/conventional monitoring, the Contractor will determine/monitor treatment system performance through observation/maintenance of pumps, piping, metering, and other components of the system. Visual observations of the discharge for sheen will also provide continuous feedback on performance. The Contractor has the option to send contaminated contact water to an offsite facility for treatment. If this
occurs, sampling requirements will be determined by the facility, and the sampling described in the plan will not be used.

**B2.7.1 Whole Effluent Toxicity**

One effluent sample will also be collected and sent to an EPA-approved laboratory for whole effluent toxicity testing in accordance with EPA guidance for short-term methods to assess chronic toxicity of effluent on marine organisms (EPA 2002). The test organisms include the sheepshead minnow (*Cyprinodon variegatus*), the inland silverside (*Menidia beryllina*), the mysid (*Mysidopsis bahia*), the sea urchin (*Arbacia punctulata*), and the red macroalga (*Champia parvula*). The organisms used should be disease-free and appear healthy, behave normally, feed well, and have low mortality in cultures, during holding, and in test control.

The quality of water used for test organism culturing and for dilution water used in toxicity tests is extremely important. Water for these two uses should come from the same source. Effluent water can be tested at 100% strength or diluted with control seawater at various ratios, e.g., 50:50, 25:75. The effluent tests are compared to a control sample containing no effluent to determine chronic effects from the effluent on marine organisms. The Contractor or a subcontractor to the prime construction contractor will be responsible for conducting this test, and will therefore hire the laboratory and determine the methods for testing the effluent with that laboratory. The details will be provided in the Construction Water Management System Plan accompanying the RAWP.

**B2.8 Sampling Equipment**

Field equipment and supplies include sampling equipment (e.g., bowls, tape measures), utensils (e.g., spoons), decontamination supplies, sample containers, coolers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., hard hats, gloves) that are required to ensure the health and safety of field personnel will be described in the Site-Specific Health and Safety Plan. Sample containers, distilled/deionized water, coolers, and packaging material will be supplied by the analytical laboratory.

**B2.9 Decontamination**

The stainless-steel spades and other sampling equipment will be rinsed with distilled water and washed with Liqui-noxTM detergent prior to use and between sampling stations. The following decontamination steps will be performed on stainless-steel bowls and spoons using for compositing prior to use at each station:

- Rinse with distilled water
- Wash with Liqui-noxTM
- Double rinse with distilled/deionized water
- Final rinse with distilled/deionized water.
If a residual petroleum sheen remains on the sampling equipment or is difficult to remove using the standard decontaminations procedures above, a hexane rinse may be added; followed by a final rinse with distilled/deionized water. Sample equipment will be kept wrapped in aluminum foil until time for use. To minimize sample cross-contamination, disposable gloves will be replaced between samples, with a sample being defined as the three grab locations as one “sample” for composite samples. Wash water will be collected and placed in the onsite water treatment system.

Geoprobe sleeves are disposable, and subsurface soil will be placed in containers using gloved hands. Gloves will be changed between each sample. Therefore, little to no equipment will require decontamination (or rinse blanks) for North Building subsurface characterization.

**B2.10 Sampling Containers**

To avoid potential field bias associated with filling individual sample jars for each analysis to be performed at the laboratory (potentially placing soil or sediment of different grain sizes in each jar), all soil/sediment for each sample will be placed in one large sampling container (1-quart glass jar). Distribution of material for each individual test (e.g., for PCB Aroclor analysis) will occur at the laboratory. For soil, this distribution will be performed using a subsampling method after the soil has been dried and sieved (Attachment A).

Requirements for sample containers and storage temperature are provided in Tables A6-1 and A7-1. None of the soil samples, with the exception of the BTEX samples in the UST removal, will require chemical preservation. Water samples analyzed for dissolved arsenic will require preservative (nitric acid). All sample containers will have screw-type lids to ensure adequate sealing. Lids of the glass containers will have Teflon™ inserts to prevent sample reaction with the plastic lid and to improve the quality of the seal. When required for equipment rinse blanks, preservative will be added to containers at the laboratory prior to shipment to the sampling site.Commercially available, pre-cleaned jars will be used, and the laboratory will maintain a record of certification from the suppliers. The container shipment documentation will record batch numbers for the bottles. With this documentation, containers can be traced to the supplier, and bottle rinse blank results can be reviewed. The container documentation from the laboratory will be archived in the Port consultant’s project file for Port work and in the Contractor’s file for water treatment sampling.

**B2.11 Field Log Book**

All field activities and observations will be noted in a field log book at the time they occur. The field log book will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, types and number of samples collected, weather conditions, concurrent site activities, health and safety meetings conducted (tailgate meeting), and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from this plan) and the
reasons for these changes will be documented in the field log book. The log book will identify onsite visitors observing the sampling; the site will have many concurrent activities and many onsite personnel; therefore only those specifically visiting/observing confirmation sampling activities will be documented. The Field Manager is responsible for ensuring that the field log book and all field data forms are correct.

All field activities and observations will be noted in a field log book during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later if necessary. Requirements for log book entries include:

- Log books will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour (military) clock (e.g., 0900 for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When field activity is complete, the log book will be entered into the project file.
- The person recording the information must initial and date each page of the field log book. If more than one individual makes entries on the same page, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry.
- The Field Manager, after reading the day's entries, also must sign and date the last page of each daily entry. Log book corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed, dated, and explained.

B3 Sample Handling and Custody

Soil and sediment sampling containers will be filled to minimize head space, and will be appropriately labeled and stored prior to shipment or delivery to the laboratory. Reusable sampling equipment such as stainless steel spoons and bowls shall be decontaminated between samples (not between individual locations comprising a composite sample).

Samples must be packed to prevent damage to the sample containers and labeled to allow sample identification. All samples must be packaged so that they do not leak, break, vaporize or cause cross-contamination of other samples. Each individual sample must be properly labeled and identified. When refrigeration is required for sample preservation, samples must be kept cool, be means of ice packs in coolers, during the time between collection and final packaging.
All samples must be clearly identified immediately upon collection. Each sample container label will list:

- Client and project name
- A unique sample description/sample ID
- Sample collection date and time.

Additionally, the sample bottle label may include:

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

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

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

When transferring custody, both the staff relinquishing custody of samples and the staff receiving custody of samples will sign, date, and note the time on the form. If samples are to leave the collector’s possession for shipment to the laboratory, the subsequent packaging procedures will be followed. All samples will be stored appropriately by the laboratory.

**B4 Analytical Methods**

All sediment confirmation samples will be analyzed for PCB Aroclors, arsenic, phenol, and PAHs on a rapid turn-around basis (24 to 48 hours) because these data will be used to make decisions regarding the adequacy of dredging (i.e., RvAL achievement). Six of the samples will be analyzed, over the standard duration, for dioxins/furans. The data will not be received until most or all dredging is completed, and likely not until at least some backfilling has occurred.
All soil samples will be analyzed for PCB Aroclors, cPAHs, and petroleum hydrocarbons (diesel and lube oil ranges). A subset of samples will be analyzed for silver (10 samples) and dioxins/furans (6 samples). Analyses will be completed by the methods in Table A6-1. These data will be used for confirmation of excavation completion, and therefore they will be analyzed on a rapid turnaround basis. These methods may be modified in some cases to optimize reporting limits as noted below.

Total organic carbon (TOC) will be determined for sediment samples according to Plumb (1981). Samples will be pretreated with hydrochloric acid to remove inorganic carbon, dried at 70°C, and analyzed by combustion at 800°C in an induction furnace with infrared detection of the evolved carbon dioxide.

Total solids will be determined according to PSEP (1986). These results will be used to calculate the amount of wet material needed for extraction of PAHs, phenol, and PCBs and to calculate results on a dry-weight basis.

PAHs and phenol will be analyzed by EPA SW-846 Method 8270C, with modifications recommended by PSEP (1997) to allow lower reporting limits. Modifications will include the use of a larger sample volume, corresponding to 50 g of dry sediment and a final extract volume of 0.5 mL. Samples will be extracted by sonication (EPA Method 3550B). Gel permeation chromatography (EPA Method 3640A) will be used to clean up the sample extracts. Other cleanup procedures will be used, as necessary, to generate high-quality data.

PCB Aroclors will be analyzed using EPA SW-846 Method 8082 with modifications recommended by PSEP (1997) to allow lower reporting limits. Modifications will include the use of a larger sample volume, corresponding to 25 g of dry sediment and a final extract volume of 5 mL. Modifications also include analysis of a lower standard as part of the initial calibration, to extend the calibration range and improve the MRL. Samples will be extracted by sonication (EPA Method 3550B). EPA method 8082 also includes provisions for acid cleanup of sample extracts, which will be used, if necessary, to meet reporting limit requirements.

Arsenic and silver will be analyzed by EPA Method 6010B (inductively coupled plasma-atomic emission spectrometry). Equipment rinse blanks for metals will be prepared using EPA method 3005A.

**B4.1 Laboratory Soil Sample Preparation**

Soil samples will be dried at the laboratory until soil is dry enough such that it does not adhere to a spatula. Soil may be dried in the ambient air or in an oven at the laboratory’s discretion. A memorandum describing a drying evaluation conducted by ARI during the
2012 Pre-Confirmation event is included in Attachment B. The evaluation revealed that oven drying did not lead to losses of cPAHs from soil relative to air drying.

Laboratory staff will then pass the soil through a 2-millimeter sieve and use the portion that passes the sieve for analysis. The samples must be dry enough to pass through the sieve (evaluated by whether the soil sticks to a spatula). The soil particles that pass through the screen will be spread on a tray, and a random subsampling method will be used to grab soil to be consumed in the analytical equipment (Attachment A).

B5 Quality Control

B5.1 Laboratory Quality Control

All QC procedures specified for EPA Method 8082 will be employed by the laboratory, including:

- The surrogate compound DCB will be included in every sample and standard to monitor extraction efficiency and retention time shifts as required by EPA Method 8082.
- For every individual Aroclor identified in each sample, a standard will be analyzed within 24 hours of analysis of the sample; the standard will be analyzed within a valid 12-hour analysis sequence; Aroclors 1248, 1254, and 1260 have been detected in Upland Area soils and sediment, and the laboratory will have these standards prepared and run (standard curve; relationship of detector output to analyte concentration) prior to analyzing the samples.
- To facilitate validation, the laboratory will provide a summary of retention times, retention time windows, and retention time shifts for every sample in a format similar to Contract Laboratory Program (CLP) Form 10B. Retention time shifts for the surrogate compounds will be included with the run log (CLP Form 8D) (EPA 2008, 2010).

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

- Initial and continuing calibration: A calibration standard will be analyzed each time an instrument is calibrated. The instruments used to perform the analyses will be calibrated, and the calibrations will be verified as required by EPA methodologies. For example, a standard five-point initial calibration will be utilized to determine the linearity of response with the gas chromatograph/electron capture detection. Once calibrated, the system must
be verified every 12 hours. All relative response factors, as specified by the analytical method, must be greater than or equal to 0.05. All relative standard deviations, as specified by the analytical method, must be less than or equal to 30 percent for the initial calibration and less than or equal to 25 percent for the continuing calibration.

- **Laboratory control sample:** The LCS is an analyte-free water or solid phase sample that is spiked with target analytes of known concentration. LCS for sediment will use the free Standard Reference Material (SRM) available for Puget Sound. The Puget Sound SRM has been established for dioxins/furans, and PCB congener analysis using high resolution gas chromatography / high resolution mass spectrometry methods. This SRM is also suitable for Aroclor analysis using gas chromatography/electron capture detection methods (USACE 2012). The LCS will be processed through the entire method procedure, and the results will be examined for target analyte recovery (accuracy). Precision evaluations will be generated using an LCSD. The LCS/LCSD results will be used as a fall-back position by the laboratory in cases where the MS/MSD has failed to achieve acceptable recovery and/or precision. Inability to obtain acceptable LCS results will be directly related to an inability to generate acceptable results for any sample. One LCS/LCSD pair will be analyzed for each extraction batch.

- **Method blank analysis:** The method blank is utilized to rule out laboratory-introduced contamination by reagents or method preparation. Concentrations of compounds detected in the blank will be compared to the samples. Any concentration of common laboratory contaminants (i.e., phthalates, acetone, methylene chloride, or 2-butane) in a sample lower than 10 times that found in the blank will be considered a laboratory contaminant. For other contaminants, any compounds detected at concentrations lower than five times that found in the blank will be considered laboratory contamination (EPA 2008). Values reported for the method blanks are expected to be below the detection limits for all compounds, except the common laboratory contaminants. Deviations from this must be explained in the laboratory project narrative(s). One method blank will be analyzed for each extraction/digestion batch.

- **Matrix spike analysis:** An MS is the addition of a known amount of target analyte to a sample. Comparison of target analyte concentration in the spiked sample to that in the unspiked sample (background) using the equation in Section A7.2 is used to determine accuracy (the ability of the test to provide measured results matching the true concentration). Precision is determined with an MS/MSD pair (RPD equation in Section A7.1). One MS/MSD will be analyzed in every 20 samples.

- **Surrogate evaluations:** Surrogate recovery is a QC measure used in organics analyses. Surrogates are compounds added to every sample at the initiation of preparation to monitor the success of the sample preparation on an individual sample basis (accuracy). Although some methods have established surrogate recovery acceptance criteria that are part of the method or contract
compliance, for the most part, acceptable surrogate recoveries need to be
determined by the laboratory. Recoveries of surrogates will be calculated for all
samples, blanks, and QC samples. Acceptance limits will be listed for each
surrogate and sample type and will be compared against the actual result by the
data validator.

- **Laboratory management review:** The Laboratory QA Officer will review all
analytical results prior to final external distribution (preliminary results will be
reported before this review). If the QA Officer finds that the data meet project
quality requirements, the data will be released as “final” information. Data
which are not acceptable will be held until the problems are resolved, or the
data will be flagged appropriately.

**B5.2 Field Quality Control**

Field QC samples (duplicates and rinsate blanks) are useful in identifying problems with
sample collection or sample processing. A minimum of one duplicate sample will be
collected from the material homogenized from every 10 field samples from each sampling
unit (Upland Area, riverbank). Each field duplicate will be analyzed for the same
parameters as the parent samples to evaluate heterogeneity attributable to sample
handling. The RPD for homogenate duplicate samples must be below 50% for the data to
be acceptable.

At least one equipment rinsate sample will be collected after equipment decontamination
for every 20 soil samples collected. Equipment rinsate blanks will be collected for each
type of sampling equipment that comes into contact with sample material, and will be
analyzed for the same parameters as the soil/sediment samples which the equipment was
used to collect.

**B6 Instrument and Equipment Testing, Inspection, and
Maintenance**

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

Testing, inspection, and maintenance will be carried out on all field and laboratory
equipment in accordance with manufacturer’s recommendations and professional
judgment. Hand-held field monitors will be used to monitor treatment water discharge for
turbidity, dissolved oxygen, pH, and temperature. Each instrument will be calibrated and
maintained according to the manufacturer’s recommendations. Documentation relating to
this equipment will be included as an attachment to the QAPP when it is finalized; it will be
provided by the Contractor or subcontractor conducting the water monitoring.
Analytical laboratory equipment preventative testing, inspection, and maintenance will be addressed in the laboratory QA manual, which will be kept on file at the contracted laboratory.

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

**B7 Instrument and Equipment Calibration and Frequency**

Field equipment/instrumentation used for sample collection and for monitoring will be subject to the following calibration requirements:

- **Identification.** Either the manufacturer’s serial number or the calibration system identification number will be used to uniquely identify equipment. This identification, along with a label indicating when the next calibration is due, will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference.

- **Standards.** Equipment will be calibrated, whenever possible, against reference standards having known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical constraints. If national standards do not exist, the basis for calibration will be described and documented.

- **Frequency.** Equipment will be calibrated at prescribed intervals and/or prior to use. Frequency will be based on the type of equipment, inherent stability, manufacturers’ recommendations, intended use, and observation of equipment readings over the course of the field work. All sensitive equipment to be used in the field or laboratory will be calibrated or checked prior to use.

- **Records.** Calibration records (certifications, logs, etc.) will be maintained for all measuring and test equipment used.

If equipment is found to be out of calibration, the validity of previous measurements will be investigated, and/or corrective action will be implemented. The laboratory Project Manager will lead the evaluation process, which will be documented in the field or laboratory log book.

All laboratory calibration requirements must be met before sample analysis may begin. The laboratory will follow the calibration procedures dictated by the analytical methods to be performed. If calibration non-conformances are noted, samples will be reanalyzed under compliant calibration conditions within method-specified hold times (likely not applicable because analyses are to be expedited).
B8 Inspection and Acceptance of Supplies and Consumables

The Field Manager will be responsible for material procurement and control. The Field Manager will verify upon receipt that materials meet the required specifications and that, as applicable, material or standard certification documents are provided, maintained, and properly stored with the project files. The Field Manager will also verify that material storage is properly maintained and that contamination of materials is not allowed.

The laboratory must document and follow procedures related to:
- Checking purity standards, reagent grade water, and other chemicals relative to intended use
- Preparing and storing chemicals
- Handling disposable glassware (including appropriate grade).

The Field Manager will be responsible for procuring and transporting the appropriate sample containers, equipment, and consumables (e.g., soap) to T-117. The containers will be pre-cleaned and certified by lot. If needed, reagents provided will be of the appropriate grade for the analysis. Records of these certifications and grades of material will be maintained on file at the laboratory.

B9 Non-Direct Measurements

Existing chemical data were used to design the excavation prisms. They were confirmed through the EE/CA (Windward et al. 2010) process (by which the database was prepared) and through the 2011 Pre-Design Sampling (Appendix A of the Design Report) to be of appropriate quality.

B10 Data Management

B10.1 Sample Numbering

Upland Area soil samples will be labeled as “conf-SS-x-y” where “x” is the grid cell name, i.e., from A to RR, and “y” is the elevations from which the samples were collected. “SS” represents surface soil. If any additional excavation is required for any grid cell, the composite sample collected after this additional excavation will have the “y” adjusted to the new elevations at the bottom of the excavations after the cleanup pass. All field duplicate sample names will be identical to their parent samples, except that a “1” will proceed the “x”, e.g., “conf-SS-1AA-10,12”. Grid cell IDs, sample location IDs (the three grab locations making up each composite sample), and sample IDs are included in Table B2-2 (Tables B2-1 and B2-2).

In grid cells where cleanup passes are conducted, replacement three-part composite samples will be collected. Because each sample will be at a 1-ft lower elevation than the
original confirmation sample, the elevation component (y) of the sample ID will change. This will distinguish multiple samples from the same grid cell (sample at design elevation vs. sample collected after cleanup pass). For each new sample collected in a grid cell, new grab locations will be generated following the methodology in B2.3. New random numbers will be used to generate the new locations.

North riverbank samples will be labeled as “conf-NbankA-0” through “conf-NbankC-0”. South riverbank sample locations will be labeled in a similar fashion, replacing the “N” with an “S”. The letters A through C represent the four units over which excavation completion decisions will be made. The “-0” represents sample collection at the design grade. Each of these sample names identifies a 6-part composite made along 2 transects. Sediment/soil will be collected from three locations (a,b,c) along each transect, and soil from two transects (1,2) will be combined into one composite sample per unit. One field replicate will be collected from the transect Nbank-B, and the sample will be labeled as “conf-Nbank-BB”. Table B2-3 lists the area, unit, transect, grab along unit, and sample IDs (Table B2-3).

If riverbank data exceed sediment RvALs, a 1-ft deep (into the bank face) cleanup pass will be conducted across the unit. New confirmation samples will be collected from newly generated locations, using the same methods as described in B2.4. New random numbers will be used to generate these post-cleanup pass confirmation locations. To distinguish the samples collected at the design grade from any collected after cleanup passes, the suffix in the sample IDs described above will change from “-0” to “-1” to identifies the first cleanup pass.

Sediment Area grab samples will be labeled as “conf-SG-y-0”, where “y” is a number from 1 through 14, for the 14 locations shown on Figure B1-2. The suffix “-0” represents the design grade samples. Samples collected after cleanup passes will be in the same locations as the original samples. The sample ID suffix will change from “-0” to “-1” to represent the first cleanup pass sample. “SG” represents sediment grab. Field duplicates will be named similarly to their parent samples, but the numerical location ID will be repeated. For example, conf-SG-44-0 is a design grade duplicate from location 4. Table B2-4 lists the sediment confirmation sample IDs.

Sediment perimeter samples will be labeled as “pre-perim-x”, where “x” is a number from 1 through 6, for 5 locations and 1 field duplicate (Table B2-5). “Pre” identifies samples collected before dredging at T-117 begins. Samples collected after completion of dredging (and after completion of Boeing Plant 2 and Jorgensen Forge dredging) will have “post” prefix in lieu of the “pre” prefix.

Samples from the North Building soil characterization borings will be labeled as “Nbldg-SB-x-yy”, where “x” is a sequential number from 1 through 6 representing the 6 borings. “YY” represents the depth range in ft bgs from where the sample was collected. Field replicates will be analyzed at a 10% frequency, specific to each analyte. Field replicates will be
labeled just like their parent samples, but will have a “1” before the “x” in the sample ID. Table B2-6 lists the boring ID, sample IDs, and analytes (Table B2-6).

Because the Contractor is collecting treatment plant discharge water samples, the nomenclature for those samples will not be established in this QAPP.

**B10.2 Database Management**

Analytical laboratories will submit final data in EDD format and laboratory reports as PDF files. The Laboratory Project Manager and the Crete QA Officer will establish the specific data delivery format for preliminary data when the contract for this work is established. Preliminary data are to be released in electronic format to the QA Officer and Field Manager as soon possible. This may be through an ftp site that the data users can log in to, by an email sent to the QA Officer and Field Manager, or by some other means to transfer the data in a timely manner. Decisions regarding excavation completion will need to be made quickly (within 24 to 48 hours) to allow the Contractor to complete the work within the schedule. The in-water work schedule is restricted by an allowable work window from December 1, 2013 to February 14, 2014.

The project Access database was developed from the EE/CA database and amended with soil and sediment data collected in 2011. It contains a field indicating which sample represent soil that has been excavated during historical removal actions: utility trench cleanout, underground storage tank removal/closure, and two time-critical removal actions (TCRAs in 1999 and 2006). Records in this “removed” field will be adjusted (i.e., changed to “yes”) for data representing soil and sediment excavated during this NTCRA. A determination of which samples represent removed material will be made by comparing the survey-provided ground surface/mudline elevations collected immediately following excavation to the bottom elevation of each sample. A new database field listing the event when removal occurred (e.g., NTCRA, 1999 TCRA) will be added to the database. These revisions undergo 100% QC.

Post-excavation confirmation data that characterize soil/sediment that is removed with cleanup passes will be added to the database with the “removed” field marked as “yes”. The removal basis field will be populated with “NTCRA additional pass”. The current project database describes samples relative to depth below ground surface or below mudline. It does not contain elevation information. To avoid confusion regarding “surface” samples collected at the bottom of excavations, fields containing the top and bottom elevations in ft MLLW will be added to the database. The depth below ground surface fields will be left blank for these samples because depth is a relative term, and the existing ground surface and the post-site completion ground surface will not be equivalent everywhere on the site.

Elevations will be based on post-excavation topographic and bathymetric surveys to be completed by the Contractor to verify the excavations have met design grades. In the Upland elevations can be recorded on field logs by an understanding of the elevation to
which each soil prism was excavated. If the Contractor uses side slopes between prisms, elevation will need to be obtained in another manner. Riverbank, soil side slopes, and sediment sample location elevations will be approximated in field logs and verified in a computer aided drafting (CAD) program by mapping the sample locations on a basemap of the post-excavation topography and bathymetry and exporting an elevation for each sample location. This method will be used to verify the elevation of samples collected from soil excavation bottoms, as well.

Upland soil and riverbank samples will be composed of three-part composites. The location (easting, northing, and elevation) will be determined and recorded for all three locations comprising the composite. One location for each sample (the “B” grab in each grid cell, and the center grab location of each riverbank transect) will be populated in the project database to describe the sample itself. Sediment samples are not to be composited, so the coordinates will be those recorded by the vessel’s GPS (each sample corresponds to one location). A post-excavation elevation of each location will be recorded in the database with the sample’s laboratory data.

If additional excavation passes are necessary, a new sample will be collected from the newly-excavated surface. It will become a part of the database. For soil RvAL compliance, the population of soil data, as well as individual samples, is compared to the criteria, by the MTCA 3-part rule. When additional excavation passes are required, the newest data will replace the data representing the removed soil in the population. The database “removed” field will reflect the final complete excavation surface after all cleanup passes are completed.

The main soil/sediment table in the database contains entries for every analyzed sample. A location-specific table will be added to the database. It will contain an entry for every soil grab. Field will include the grid cell ID, the boring ID, the boring coordinates, the soil collection top and bottom elevations, the sample type (i.e., composite) that the soil was used in, and those sample IDs. It will also have a yes/no removed field indicating whether the grab represents soil that was removed during the excavation or whether it represents post-excavation bottom soil, used in the MTCA 3-part confirmation dataset.

When QC of all database fields is completed, the entire database, along with the laboratory EDDs, and any Port-required import files will be provided to the Port for incorporation to the Port-maintained database. The Port will load the data to Washington Department of Ecology’s Environmental Information Management System.

All hard copies of confirmation sampling field documentation will be filed in the Port consultant’s library, or as scanned PDFs. Field forms will also be scanned to a PDF file and stored in the electronic project library. All hard copies of water discharge monitoring documentation will be stored by the Contractor. Scanned copies of field documentation will be presented in the Removal Action Construction Report.
## Table B1-1 Soil and Sediment Sampling Methodology and RvAL Evaluation Process

<table>
<thead>
<tr>
<th>Sampling Unit</th>
<th>Frequency</th>
<th>COCs</th>
<th>Performance Standard</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediment Confirmation</td>
<td>14 samples; not composited</td>
<td>PCBs, PAHs, phenol, arsenic in all samples; dioxins/furans in 6 samples (a nearshore and offshore sample from each dredge unit, identified in Table B2-4)</td>
<td>No exceedance of sediment RvALs in any sample; an exceedance of 5x RvAL or CSL in offshore samples requires dredging of the entire dredging unit</td>
<td>The entire nearshore or offshore half of a dredging unit will be subject to a cleanup pass if any one nearshore or offshore sample, respectively, fails the RvAL. A CSL or 5-times RvAL exceedance in the offshore row will result in the entire unit being re-dredged.</td>
</tr>
<tr>
<td>Sediment Perimeter</td>
<td>Five samples located around Sediment Area sampled two times</td>
<td>Sediment COCs and SMS chemicals</td>
<td>Pre- and post-dredging samples for information</td>
<td>Data are indicative of T-117 dredging/backfilling performance, as well as potential impacts from other dredging projects.</td>
</tr>
<tr>
<td>Riverbank (first pass)</td>
<td>Six samples in each of the north and south bank units. Each sample is composed of a 3-part composite collected along two transects aligned perpendicular to the toe of the bank.</td>
<td>All sediment COCs except dioxins/furans</td>
<td>No exceedance of indicator sediment RvALs in any sample</td>
<td>Samples must be collected when the tide is below the bank.</td>
</tr>
<tr>
<td>Riverbank (additional passes if required)</td>
<td>Collect a 6-part composite from the unit where the cleanup pass occurred</td>
<td>Indicator soil COCs: PCBs, cPAHs, TPH</td>
<td>No exceedance of indicator soil RvALs in any sample</td>
<td></td>
</tr>
<tr>
<td>Upland Area</td>
<td>One excavation bottom sample in every grid cell; each sample is a composite of three grabs. Grid is aligned with excavation prisms.</td>
<td>Indicator soil COCs plus dioxins/furans in 6 samples and silver in 10 samples(^1).</td>
<td>MTCA 3-part rule: No sample more than 2x RvALs; no more than 10% above RvALs; 95% UCL to be below RvALs.</td>
<td>Include data from un-excavated areas; collect samples after stockpiles are removed. If stockpiles are placed on excavated/backfilled areas, the sample collected after the stockpile is removed is not part of the confirmation dataset. The dataset is from the post-excavation surface prior to regrading and backfilling.</td>
</tr>
</tbody>
</table>

Notes: The data from the 9 pre-confirmation grid cells will be included in the confirmation dataset for each soil COC. Arsenic will not be used to guide soil excavation because its RvAL is equal to natural background. COC = contaminant of concern; MTCA = Model Toxics Control Act; RvAL = removal action level.
### Table B1-2 Removal Action Levels

<table>
<thead>
<tr>
<th>Contaminant of Concern</th>
<th>Removal Action Level</th>
<th>Soil</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator COCs analyzed in all samples</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Petroleum Hydrocarbons</td>
<td>200 mg/kg dw (as diesel in top 6 ft)</td>
<td>90 µg TEQ/kg dw</td>
<td>n/a; not a sediment COC</td>
</tr>
<tr>
<td>cPAHs</td>
<td>140 µg TEQ/kg dw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PCBs</td>
<td>0.65 mg/kg dw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Methyl naphthalene</td>
<td>n/a</td>
<td>38 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>n/a</td>
<td>16 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Anthracene</td>
<td>n/a</td>
<td>220 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Dibenzofuran</td>
<td>n/a</td>
<td>15 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>n/a</td>
<td>160 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Fluorene</td>
<td>n/a</td>
<td>23 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>n/a</td>
<td>100 mg/kg oc</td>
<td></td>
</tr>
<tr>
<td>Phenol</td>
<td>n/a</td>
<td>420 µg/kg dw</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>n/a; not an indicator of soil completion</td>
<td>12 mg/kg dw</td>
<td></td>
</tr>
<tr>
<td><strong>For confirmation in a subset of grid cells/sediment samples only</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>2 mg/kg dw (10 grid cells*)</td>
<td>n/a; not a sediment COC</td>
<td></td>
</tr>
<tr>
<td>Dioxins/furans</td>
<td>11 ng TEQ/kg dw (6 grid cells*)</td>
<td>13 ng TEQ/kg dw (6 samples)</td>
<td></td>
</tr>
<tr>
<td><strong>Not to be analyzed in soil</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>7.3 mg/kg dw; not to be analyzed; not an indicator for soil completion</td>
<td>n/a; arsenic to be analyzed in sediment; see above</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. oc = organic carbon normalized; if sample-specific total organic carbon (TOC) is between 0.5 and 4%, dry weight concentrations of non-polar organic compounds analyzed in sediment will be normalized using the sample-specific TOC. If TOC is outside this range, data will be compared to the lowest apparent effects thresholds.
2. TEQ = toxicity equivalent; dioxin/furan and cPAH TEQs will be calculated using mammalian toxicity equivalency factors.
3. n/a = not applicable, not a COC for this medium/scenario; RvAL = removal action level; SMS = Sediment Management Standards; SQS = sediment quality standard.
   a. The silver and dioxin/furan data from the 9 pre-confirmation grid cells will be included in the confirmation dataset.
Table B1-3 Discharge Water Sampling Frequency and Criteria

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Frequency</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Field Parameters (for discharge to waters of excellent quality)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oily Sheen (visual observation)</td>
<td>2x daily or continuously</td>
<td>none observed</td>
</tr>
<tr>
<td></td>
<td>during plant operation</td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>&lt;5 NTU over background</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of receiving water</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>&lt;60.8° F</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>Must be &gt;6 mg/L</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Between 7.0 and 8.5</td>
<td></td>
</tr>
<tr>
<td><strong>Chemical Criteria (µg/L)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PCBs</td>
<td>Weekly</td>
<td>0.03</td>
</tr>
<tr>
<td>PAHs</td>
<td>Two times during NTCRA</td>
<td>No criteria</td>
</tr>
<tr>
<td>Dioxins/Furans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>Weekly</td>
<td>36</td>
</tr>
<tr>
<td>Cadmium</td>
<td></td>
<td>9.3</td>
</tr>
<tr>
<td>Chromium</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Copper</td>
<td></td>
<td>3.1</td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td>8.1</td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td>0.025</td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
<td>8.2</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>Zinc</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td><strong>Whole Effluent Toxicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic effects to marine</td>
<td>Two times during NTCRA</td>
<td>Effects relative to control</td>
</tr>
<tr>
<td>organisms</td>
<td></td>
<td></td>
</tr>
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</table>

Note: Field parameter criteria are for marine waters of “excellent quality” as defined in WAC173-201A-210. Chemical criteria are chronic marine criteria for toxic substances defined in WAC173-201A Table 240(3).
<table>
<thead>
<tr>
<th>Grid Cell</th>
<th>Elevation(s) (ft)</th>
<th>Location of baseline: side of grid cell</th>
<th>Starting corner</th>
<th>Direction along baseline</th>
<th>Grid cell baseline length (ft)</th>
<th>Direction from Baseline</th>
<th>Sample Prefix</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>17</td>
<td>W NW S</td>
<td>S</td>
<td>113.9</td>
<td>38.0</td>
<td>E</td>
<td>conf-SS-A</td>
<td>baseline unconnected; does not include small E-W jog in W boundary.</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>E NE S</td>
<td>S</td>
<td>99.1</td>
<td>33.0</td>
<td>W</td>
<td>conf-SS-B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>16.18</td>
<td>E NE S</td>
<td>S</td>
<td>70.5</td>
<td>23.5</td>
<td>W</td>
<td>conf-SS-C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>17.23</td>
<td>E NE S</td>
<td>S</td>
<td>103.8</td>
<td>34.4</td>
<td>W</td>
<td>conf-SS-D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>18</td>
<td>E NE S</td>
<td>S</td>
<td>105.8</td>
<td>35.1</td>
<td>W</td>
<td>conf-SS-E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>12, 17</td>
<td>E NE S</td>
<td>S</td>
<td>78.4</td>
<td>26.1</td>
<td>W</td>
<td>conf-SS-F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>% No basin and no excavation</td>
<td>W NW S</td>
<td>S</td>
<td>55.2</td>
<td>18.4</td>
<td>E</td>
<td>conf-SS-G</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>% No basin and no excavation</td>
<td>W NW S</td>
<td>S</td>
<td>85</td>
<td>28.3</td>
<td>E</td>
<td>conf-SS-H</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>% No basin and no excavation</td>
<td>W NW S</td>
<td>S</td>
<td>54.6</td>
<td>18.2</td>
<td>E</td>
<td>conf-SS-I</td>
<td></td>
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<tr>
<td>J</td>
<td>% No basin and no excavation</td>
<td>S SE W</td>
<td>S</td>
<td>130.7</td>
<td>43.0</td>
<td>N</td>
<td>conf-SS-J</td>
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<tr>
<td>K</td>
<td>17,19</td>
<td>N NE W</td>
<td>S</td>
<td>130.7</td>
<td>43.0</td>
<td>S</td>
<td>conf-SS-K</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>9, 12, 14</td>
<td>2 N sides</td>
<td>S</td>
<td>57.8</td>
<td>19.3</td>
<td>S</td>
<td>conf-SS-L</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>13</td>
<td>S SE W</td>
<td>S</td>
<td>56.8</td>
<td>18.9</td>
<td>N</td>
<td>conf-SS-M</td>
<td>baseline unconnected: does not include E-W jog in S boundary; same baseline as grid cell (L)</td>
</tr>
<tr>
<td>N</td>
<td>10,13</td>
<td>S SE W</td>
<td>S</td>
<td>66.1</td>
<td>15.4</td>
<td>N</td>
<td>conf-SS-N</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>9, 12, 14</td>
<td>S SE W</td>
<td>S</td>
<td>59.1</td>
<td>19.7</td>
<td>N</td>
<td>conf-SS-O</td>
<td>baseline unconnected: does not include E-W jog in S boundary; same baseline as grid cell (Q)</td>
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<tr>
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<td>15.8</td>
<td>W</td>
<td>conf-SS-P</td>
<td></td>
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<tr>
<td>Q</td>
<td>9, 11</td>
<td>N NE W</td>
<td>S</td>
<td>62.5</td>
<td>20.8</td>
<td>S</td>
<td>conf-SS-Q</td>
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<td>17</td>
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<td>S</td>
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<td>30.6</td>
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<td>12</td>
<td>N NE W</td>
<td>S</td>
<td>67.3</td>
<td>22.4</td>
<td>S</td>
<td>conf-SS-S</td>
<td>baseline unconnected: does not include E-W running line that forms a jog in the E-W running boundary of grid cell</td>
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<tr>
<td>T</td>
<td>no excavation</td>
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<td>S</td>
<td>76.2</td>
<td>24.7</td>
<td>W</td>
<td>conf-SS-T</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>no excavation</td>
<td>W NW S</td>
<td>S</td>
<td>76.2</td>
<td>25.4</td>
<td>E</td>
<td>conf-SS-U</td>
<td></td>
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<tr>
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<td>11</td>
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<td>S</td>
<td>69</td>
<td>23.0</td>
<td>S</td>
<td>conf-SS-V</td>
<td>baseline unconnected: does not include E-W running line that forms a jog in the E-W running boundary of grid cell</td>
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<td>9,11</td>
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<td>12</td>
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<td>S</td>
<td>72.5</td>
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<td>W</td>
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<td>S</td>
<td>103.3</td>
<td>34.4</td>
<td>N</td>
<td>conf-SS-Y</td>
<td>baseline unconnected: contains E-W running lines on S boundary</td>
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<tr>
<td>Z</td>
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<td>50.5</td>
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<td>conf-SS-Z</td>
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<td>AA</td>
<td>10, 12</td>
<td>W NW S</td>
<td>S</td>
<td>65.8</td>
<td>21.8</td>
<td>E</td>
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<td>BB</td>
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<td>conf-SS-BB</td>
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<tr>
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<td>25.7</td>
<td>W</td>
<td>conf-SS-CC</td>
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<td>12</td>
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<td>S</td>
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<td>26.8</td>
<td>W</td>
<td>conf-SS-DD</td>
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<tr>
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<td>10</td>
<td>W NW S</td>
<td>S</td>
<td>94</td>
<td>31.3</td>
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<td>conf-SS-EE</td>
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<tr>
<td>FF</td>
<td>15</td>
<td>N NE W</td>
<td>S</td>
<td>70.9</td>
<td>23.6</td>
<td>S</td>
<td>conf-SS-FF</td>
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<tr>
<td>GG</td>
<td>9, 11</td>
<td>N NE W</td>
<td>S</td>
<td>70.4</td>
<td>25.5</td>
<td>N</td>
<td>conf-SS-GG</td>
<td></td>
</tr>
<tr>
<td>HH</td>
<td>13</td>
<td>E NE S</td>
<td>S</td>
<td>57.5</td>
<td>19.2</td>
<td>W</td>
<td>conf-SS-HH</td>
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</tr>
<tr>
<td>II</td>
<td>20</td>
<td>E NE S</td>
<td>S</td>
<td>143.7</td>
<td>47.9</td>
<td>W</td>
<td>conf-SS-II</td>
<td></td>
</tr>
<tr>
<td>JJ</td>
<td>10</td>
<td>W NE S</td>
<td>S</td>
<td>90.1</td>
<td>30.0</td>
<td>E</td>
<td>conf-SS-JJ</td>
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<tr>
<td>KK</td>
<td>13</td>
<td>W NE S</td>
<td>S</td>
<td>90.1</td>
<td>30.0</td>
<td>E</td>
<td>conf-SS-KK</td>
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</tr>
<tr>
<td>LL</td>
<td>12</td>
<td>W NE S</td>
<td>S</td>
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<td>42.1</td>
<td>E</td>
<td>conf-SS-LL</td>
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</tr>
<tr>
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<td>S</td>
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<td>22.4</td>
<td>E</td>
<td>conf-SS-MM</td>
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</tr>
<tr>
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<td>16</td>
<td>W NE S</td>
<td>S</td>
<td>66.2</td>
<td>22.1</td>
<td>E</td>
<td>conf-SS-NN</td>
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</tr>
<tr>
<td>OO</td>
<td>16</td>
<td>W NW S</td>
<td>S</td>
<td>86.4</td>
<td>28.8</td>
<td>E</td>
<td>conf-SS-OO</td>
<td>very small portion at S end of grid cell has 0% chance of being sampled</td>
</tr>
<tr>
<td>PP</td>
<td>no excavation</td>
<td>N NE W</td>
<td>S</td>
<td>41.4</td>
<td>13.8</td>
<td>S</td>
<td>conf-SS-PP</td>
<td></td>
</tr>
<tr>
<td>QQ</td>
<td>no excavation</td>
<td>S SE W</td>
<td>S</td>
<td>53.7</td>
<td>23.2</td>
<td>N</td>
<td>conf-SS-QQ</td>
<td></td>
</tr>
<tr>
<td>RR</td>
<td>9, 16, 20, 1.5 ft jog outside of T-117</td>
<td>N NE W</td>
<td>S</td>
<td>88.5</td>
<td>29.5</td>
<td>S</td>
<td>conf-SS-RR</td>
<td>baseline unconnected: contains E-W running lines on N boundary; 0% chance of sampling very small triangular area in W end of 20 piers</td>
</tr>
</tbody>
</table>

**Legend:**
- **Sample Prefix:** conf-
- **Notes:** baseline unconnected; does not include small E-W jog in W boundary; baseline unconnected: does not include E-W jog in S boundary; same baseline as grid cell (L); baseline unconnected: contains E-W running lines on S boundary; very small portion at S end of grid cell has 0% chance of being sampled; baseline unconnected: contains E-W running lines on N boundary; 0% chance of sampling very small triangular area in W end of 20 piers.
<table>
<thead>
<tr>
<th>Grid Cell</th>
<th>Location</th>
<th>Location ID</th>
<th>Grid cell baseline length (m)</th>
<th>L/2 of grid cell baseline length (m)</th>
<th>baseline random number</th>
<th>length along baseline (from starting corner)</th>
<th>transcript location at baseline location (ft)</th>
<th>transcript random number</th>
<th>distance along transcript, from baseline (ft)</th>
<th>e</th>
<th>(g)</th>
<th>Sample ID</th>
<th>Field Replicate</th>
<th>Analyze for Silver?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>conf-02-6</td>
<td>conf-02-6</td>
<td>114.9  28.0  0.147</td>
<td>27.1</td>
<td>20.06  0.295  5.0</td>
<td>1275118</td>
<td>1507261</td>
<td>conf-G-5-17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>conf-01-6</td>
<td>conf-01-6</td>
<td>184.9  41.0  0.343</td>
<td>33.8</td>
<td>21.68  0.348  22.0</td>
<td>1275135</td>
<td>1507195</td>
<td>conf-G-9-18</td>
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<tr>
<td>C</td>
<td>conf-02-6</td>
<td>conf-02-6</td>
<td>52.4  20.0  0.145</td>
<td>18.1</td>
<td>14.86  0.237  22.0</td>
<td>1275114</td>
<td>1507061</td>
<td>conf-G-C-16,18</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>conf-03-6</td>
<td>conf-03-6</td>
<td>100.3  24.0  0.302</td>
<td>22.7</td>
<td>12.07  0.247  17.0</td>
<td>1275191</td>
<td>1507141</td>
<td>conf-G-D-21,19</td>
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<tr>
<td>E</td>
<td>conf-01-6</td>
<td>conf-01-6</td>
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<td>11.27  0.218  17.0</td>
<td>1275118</td>
<td>1507194</td>
<td>conf-G-C-19</td>
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<td>conf-03-6</td>
<td>conf-03-6</td>
<td>78.4  24.1  0.315</td>
<td>19.3</td>
<td>12.15  0.264  22.0</td>
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<td>1507218</td>
<td>conf-G-F-12,17</td>
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<tr>
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<td>conf-02-6</td>
<td>conf-02-6</td>
<td>92.7  28.0  0.328</td>
<td>23.1</td>
<td>12.23  0.266  24.0</td>
<td>1275148</td>
<td>1507304</td>
<td>conf-G-F-16,18</td>
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<tr>
<td>H</td>
<td>conf-01-6</td>
<td>conf-01-6</td>
<td>96.7  29.0  0.345</td>
<td>24.1</td>
<td>12.31  0.247  23.0</td>
<td>1275161</td>
<td>1507234</td>
<td>conf-G-F-16,18</td>
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<td>I</td>
<td>conf-02-6</td>
<td>conf-02-6</td>
<td>54.4  18.2  0.318</td>
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<td>12.48  0.287  19.0</td>
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Note: Starting corner, direction along baseline, and direction along transect from baseline provided in Table B2-1.

1. ne = no excavation; tbd = to be determined; excavation elevation, if any, will be determined by data collected from North Building borings.
2. Where cleanup passes are performed, the sample ID suffix will be revised to the post-cleanup pass bottom-of-excavation elevations.

modified on 9/26/12
## Table B2-3 Riverbank Confirmation Samples

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<th>Unit length (ft)</th>
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<th>Bank Transect location (ft from property boundary)</th>
<th>elevation range of bank excavation (ft MLLW)</th>
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<th>Plan view distance from toe to top of Bank (ft)</th>
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### Notes:
1. Bank length from Table 2-2 to Design Report.
2. In the North bank, plan view distance is 2x height of excavation because the bank excavation design is a 2:1 slope. In the South bank, the 2:1 slope does down to +4 ft MLLW, then the excavation is relatively flat down to +2 ft MLLW.
3. For any bank transects meeting an Upland Area excavation cell of +14 ft MLLW or higher, the bank portion is only +4 ft MLLW. The sloped portion up from +4 ft MLLW is part of the Upland Area grid cell.

### Coordinates

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### Notes:
1. When cleanup passes are conducted, a new 6-port composite sample will be collected, and the sample ID suffix will change from -0 to -1.
2. When a multiple pass is conducted, the second pass will be conducted on 1/28/12.
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<th>Dredge Unit</th>
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<th>Dioxins/Furans$^2$</th>
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<th>Field Replicate Sample ID</th>
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Note: 1. Indicator COCs for dredging completion are total PCB Aroclors, arsenic, PAHs, and phenol. The RvALs are to be met on a point-by-point basis.
2. Dioxins/furans will be analyzed in 6 of the samples.
3. The nearshore row starting point, distance along shore from northern end of dredging area, was found as a random number (0.688) multiplied by one-seventh of the shoreline distance (900 / 7 = 129; 0.688 * 129 = 89 ft). All other nearshore locations are 129 ft away (upstream) from the first location.

The offshore row was offset 65 feet upstream from the nearshore locations. The distance from the riverbank for each row is 1/4 and 3/4 the dredging area width for the nearshore and offshore rows, respectively.

last modified on 9/28/12
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<th>Post-Dredging Sample ID</th>
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Table B2-6 North Building Soil Borings

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Note:
1. Grid cells are only relevant for confirmation sampling after excavation. These borings are to characterize previously-unsampled soil under the North Building. After any needed excavation, and after UST removal, these grid cells will be sampled as part of the confirmation dataset. They are identified in this table only for locational reference.
C. Assessment and Oversight Elements

C1 Assessment and Response Actions

QA/QC activities will be used at two levels to inform response actions:

- Rapid turn-around preliminary data and associated field duplicate RPDs will inform the adequacy of data used to confirm excavation completion.
- All other QA samples (MS/MSD, rinsate blanks, LCS/LCSD) will be evaluated during full data validation and will be used to assign qualifiers to data, for long-term use of the data and for report generation.

Field and laboratory precision will be evaluated through the RPDs between the field duplicate and parent sample data (using calculated totals for total PCBs, TPH, and cPAH). Because preliminary data will be used to make timely decisions regarding excavation completion, RPDs between field duplicate and parent data will be calculated with the preliminary data (for each analyte). For each COC, if either the parent or the duplicate is below the RvAL (either detected or undetected), the data will be acceptable, because an RPD even as great at 50% at such low levels is not uncommon for low-concentration data (e.g., soil total PCB concentrations of 0.4 and 0.1 mg/kg dw have >100% RPD; these data are both below the RvAL of 0.65 mg/kg dw). If both the parent and the field duplicate exceed the RvAL, additional excavation will be likely (given the 3-part rule) regardless of the RPD. For accepted data, the parent concentration will be used, and the field duplicate will be used for QA purposes only. The database will store both the parent and field duplicate data.

Over the longer term, QA/QC will be conducted through data validation after complete laboratory reports are prepared. Laboratory precision will also be determined through RPDs from the MS/MSD and LCS/LCSD pairs. Laboratory accuracy will be determined through MS and blanks. The adequacy of sample collection will be evaluated through the equipment rinsate blank data. If any COCs are detected in the rinsate blank samples, environmental sample data will be qualified as being impacted by contamination.

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

- **Field staff/Manager**: during the performance of field activities, supervision of subcontractors, performance of audits
- **Laboratory staff**: during the preparation for and performance of laboratory testing, calibration of equipment, and QC activities
- **QA Staff**: during the performance of audits and during data validation, through the use of data to make decisions (i.e., do the data make sense?).
If possible, action will be taken in the field to correct any nonconformance observed during field activities. If necessary and appropriate, corrective action may consist of a modification of methods. Because sampling will take place on an actively excavation site crowded with many pieces of equipment, stockpiles, a water treatment system, and other items, procedures will need to be adaptive to meet the specific site logistics and the Contractor’s sequencing of activities. Sequencing will be described in the RAWP, which may better inform/adjust the CQAP.

If implementation of corrective action in the field is not possible, the nonconformance and its potential impact on data quality will be discussed in the report.

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

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

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

C2 Reports to Management

Following excavation completion of each distinct area: Sediment Area, Upland Area soils, and riverbank sediment/soil, a Pre-Final Construction Completion Report will be prepared by the Port. It will describe the confirmation sampling data (including any relevant statistics), any additional excavation passes (excavation completion decisions made using those data), the post-excavation topography/bathymetry data, and any deviations from the sampling plan.
The Contractor will submit daily construction quality control reports to the Port. These reports will describe construction activities; bathymetric/topographic surveys; water treatment plant inflows, monitoring data, and maintenance; and other activities defined in the Specifications. The Port will provide weekly quality assurance reports to EPA to describe construction progress, milestones, and any data collected.

The Removal Action Construction Report, to be completed within 30 days of the precertification inspection will include:

- Laboratory report PDFs and EDDs
- Data validation reports
- Field logs
- A description of the sampling methods and results.
- The Contractor will prepare weekly construction report to be delivered to the Port. The Port will use that information along with Port activities to inform EPA in weekly, if not more frequent, meetings of site progress. EPA will review preliminary data as it becomes available and confer with the Port on excavation completion decisions.
D. Data Validation and Usability

D1 Data Review, Verification, and Validation

EPA method control limits (or Washington method control limits for Northwest TPH methods) for surrogate and MS recoveries will be used to determine data quality. If surrogate or MS recoveries are not within their method-specific control limits, the analysis must be repeated. If the re-analyzed values are within required limits and holding times, they will be reported as true values. If, in the repeated analysis, the values are still outside required limits, the data will be identified and the data validator will verify the representativeness of the data following EPA guidelines. Laboratory analysts are responsible for reviewing calibration integrity, sample holding times, method compliance, and completeness of tests, forms, and log books. However, preliminary data will be used to make excavation completion decisions, which will preclude these findings.

D2 Verification and Validation Methods

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

No guidelines are available for validation of data for TOC. These data will be validated using procedures described in the functional guidelines for inorganic data review (EPA 2010), as applicable.

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

Data validation will be completed by a third-party data validator. Data validation will be completed within two weeks after receipt of the complete laboratory data package. Validation will be ongoing as data become available. Sample collection will span months. A data validation report will be included in the Removal Action Construction Report.

The laboratory will generate a fully validatable data package as defined by the CLP Guidelines. Validation will be completed at Level 4 for dioxins/furans and at Level 2B for the other COCs. The complete data validation labels will be applied to the data in addition to the validation qualifiers. Validation of the analytical data will comply with criteria set
forth in the Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 2009).

**D3 Reconciliation with User Requirements**

The QA Officer will review the field notebooks, laboratory report, and data validation report to determine if the data quality objectives have been met. Instances where the data quality objectives were not met will be documented. The usability of the data will depend on the magnitude of the data quality objective exceedance. The completeness objective is 100%. To evaluate soil excavation completion using the MTCA 3-part rule, there must be a valid data point for each analyte\(^4\) in each grid cell. Data that has been rejected will be flagged as “R” and maintained in the database. However, any “R” flagged data will not be identified until excavation completeness decisions have been made and backfill has covered the excavations.

Data that have been qualified as rejected or that have a reporting limit greater than the respective RvAL will not be considered valid for the purpose of assessing completeness. In the event of an elevated reporting limit (which would be identified prior to data validation), remaining soil from the sample (that soil which was not consumed by the analysis) could be re-analyzed by the laboratory. Discussions with laboratory staff will determine whether adjustments in the laboratory preparation, extraction, or analysis methods could lower the reporting limit. However, if data are “R” flagged during the data validation process, additional sample collection would not be problematic (and would involve subsurface collection techniques, i.e., drilling) because the excavation and backfilling would have already occurred.

The analysis of field duplicates (RPD between parent and duplicate) and of reporting limits relative to RvALs will inform data usability at the time of decision making.

\(^4\) Note that silver and dioxins/furans are to be analyzed in the samples from 10 and 6 grid cells, respectively, not from all grid cells.
E. References


Figures
QUALITY ASSURANCE PROJECT PLAN

T-117 EARLY ACTION AREA

CONFIRMATION SAMPLING LOCATIONS AND GRID CELLS

FIGURE A6-1a

2,500-SQ FT SOIL SAMPLING GRID CELL
BASELINE
GRID CELL FOR WHICH PRE-EXCAVATION DATA WILL BE USED TO CONFIRM EXCAVATION COMPLETION; POST-EXCAVATION CONFIRMATION SAMPLES WILL NOT BE COLLECTED

BOTTOM ELEVATION OF EXCAVATION IN FT MLLW
EXCAVATION UNDER THE NORTH BUILDING WILL BE DELINEATED BY SOIL DATA COLLECTED AFTER BUILDING DEMOLITION

NO EXCAVATION AREA
COMPOSITE SOIL FROM THREE LOCATIONS INTO ONE SAMPLE FOR GRID CELL
PRE-CONFIRMATION BORING
POST-EXCAVATION SURFACE LOCATION
BANK CONFIRMATION SAMPLING TRANSECT
T-117 STUDY AREA

CONSTRUCTION QUALITY ASSURANCE PLAN
QUALITY ASSURANCE PROJECT PLAN
T-117 EARLY ACTION AREA

CONFIRMATION SAMPLING LOCATIONS AND GRID CELLS

FIGURE A6-1a

MATCHLINE: FIGURE A6-1b
2,500-SQ FT SOIL SAMPLING GRID CELL
BASELINE
GRID CELL FOR WHICH PRE-EXCAVATION DATA WILL BE USED TO CONFIRM EXCAVATION COMPLETION; POST-EXCAVATION CONFIRMATION SAMPLES WILL NOT BE COLLECTED

BOTTOM ELEVATION OF EXCAVATION IN FT MLLW
EXCAVATION UNDER THE NORTH BUILDING WILL BE DELINEATED BY SOIL DATA COLLECTED AFTER BUILDING DEMOLITION

NO EXCAVATION AREA
COMPOSITE SOIL FROM THREE LOCATIONS INTO ONE SAMPLE FOR GRID CELL
PRE-CONFIRMATION BORING
POST-EXCAVATION SURFACE LOCATION
BANK CONFIRMATION SAMPLING TRANSECT
T-117 STUDY AREA

CONSTRUCTION QUALITY ASSURANCE PLAN
QUALITY ASSURANCE PROJECT PLAN
T-117 EARLY ACTION AREA

CONFIRMATION SAMPLING LOCATIONS AND GRID CELLS

FIGURE A6-1a
WATERWARD EXTENT OF LAND-BASED RIVEBANK EXCAVATION

BASELINE GRID CELL FOR WHICH PRE-EXCAVATION DATA WILL BE USED TO CONFIRM EXCAVATION COMPLETION; POST-EXCAVATION CONFIRMATION SAMPLES WILL NOT BE COLLECTED

BOTTOM ELEVATION OF EXCAVATION IN FT MLLW

EXCAVATION UNDER THE NORTH BUILDING WILL BE DELINEATED BY SOIL DATA COLLECTED AFTER BUILDING DEMOLITION

NO EXCAVATION AREA

COMPOSITE SOIL FROM THREE LOCATIONS INTO ONE SAMPLE FOR GRID CELL

PRE-CONFIRMATION BORING

POST-EXCAVATION SURFACE LOCATION

BANK CONFIRMATION SAMPLING TRANSECT

T-117 STUDY AREA

CONSTRUCTION QUALITY ASSURANCE PLAN
QUALITY ASSURANCE PROJECT PLAN
T-117 EARLY ACTION AREA

CONFIRMATION SAMPLING LOCATIONS AND GRID CELLS

FIGURE A6-1b
CONSTRUCTION QUALITY ASSURANCE PLAN
QUALITY ASSURANCE PROJECT PLAN
T-117 EARLY ACTION AREA

SEDIMENT CONFIRMATION AND PERIMETER SAMPLING LOCATIONS

FIGURE B1-2
GRID CELL FOR WHICH PRE-EXCAVATION DATA WILL BE USED TO CONFIRM EXCAVATION COMPLETION; POST-EXCAVATION CONFIRMATION SAMPLES WILL NOT BE COLLECTED

MULTIPLE PRISMS IN THE SAMPLING GRID CELL

BOTTOM ELEVATION OF EXCAVATION IN FT MLLW

EXCAVATION UNDER THE NORTH BUILDING WILL BE DELINEATED BY SOIL DATA COLLECTED AFTER BUILDING DEMOLITION

NO EXCAVATION AREA

NORTH BUILDING BORING
Attachment A
Laboratory Standard Operating Procedure for Soil Sample Preparation
Standard Operating Procedure

Crete Consulting
Incremental Sub-Sampling

SOP 1149S - Modified
Revision 001

Revision Date: 09/26/12
Effective Date: 09/26/12

Prepared By:

Approvals:

Laboratory / Section Manager

Quality Assurance
### Annual Review

SOP Number: 1149S - Modified  
Title: Incremental Sub-Sampling

The ARI employee named below certifies that this SOP is accurate, complete and requires no revisions.

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<th>Name</th>
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1. Scope and Application

1.1. This procedure describes the methods, equipment, and special conditions required to create representative analytical subsamples from a field sample utilizing an IS (Incremental Sub-Sampling) technique. The goal is to create an analytical subsample containing contaminants in equal proportion to the field sample. In many cases, field samples will have been collected with a multi-increment sampling procedure such that they are representative of the average concentration of a contaminant present within a ‘decision unit’ sampling area.

1.2. This method is not appropriate for VOC analyses. This method is not appropriate for very high concentration samples or analyses requiring less than a 10 g sample size. Modifications to procedure for lower sample amounts must be discussed with the client.

2. Summary of the Procedure

2.1. The entire sample obtained from the field (usually 1 kg or more) will be air dried or oven dried at or below 70°C, and sieved to <2 mm. Once screened, the field sample will be spread out on clean non-ink paper to a consistent thickness and sub-sampled using 30 or more randomly located increments to create a laboratory IS sample for analysis. The procedure can be replicated to collect multiple IS samples as needed. Samples will not be ground or pulverized unless specifically required by a client QAPP, as grinding is thought to expose more contaminants than would be available using normal digestion techniques for metals.

2.2. The entire IS sample generated must be prepared for analysis.

3. Definitions

3.1. IS sample: A laboratory subsample created from a field sample using incremental sub-sampling procedures.

3.2. Field sample: A sample collected in the field, by IS or other procedures, which is subsampled in the laboratory prior to analysis.

4. Interferences

4.1. Not Applicable

5. Safety

5.1. LAB WEAR – Lab wear including a lab coat, safety glasses or goggles, and gloves should be worn at all times.

5.2. WORK STATION – Keep workstation clean at all times. Wipe any spills to avoid safety hazards.
5.3. The toxicity or carcinogenicity of each reagent used in this SOP is not been precisely defined. Treat each chemical compound as a potential health hazard. Reduce exposure to all chemicals to the lowest possible level by whatever means available.

5.4. Always wear appropriate PPE (personal protective equipment) when working in the Laboratory. Gloves, safety glasses, ear protection, lab coats, respirators, face shields, etc. are provided for your protection.

5.5. DO NOT attempt to cleanup solvent spills in the laboratory. Immediately evacuate the area and contact a member of the Emergency Response Team (ERT).

5.6. Material Safety Data Sheets (MSDS) that outline hazards, exposure treatments and regulatory guidelines are available for all chemicals used in this procedure and should be consulted as the need may arise. The MSDS file is located in the central project management area. MSDS are also available online, at http://hazard.com/MSDS/.

5.7. Environmental Samples may contain hazardous waste; treat them as potential health hazards.

5.8. Use nitrile (blue) gloves when working with organic solvents; latex gloves are not appropriate for working with methylene chloride.

5.9. Dispose of all unwanted, broken glassware into a broken glassware disposal box. Inspect every piece of glassware. Do not glassware that is chipped, cracked, etched, or scratched. Glassware with minor damage should be set aside for repair.

6. Equipment and Supplies

6.1. Balance – capable of precision to ± 0.01g.

6.2. Stainless Steel Spoons and Spatulas

6.3. Drying Trays – Made of stainless steel or other appropriate material for the requested analysis.

6.4. #10 (2mm) Sieve – Made of stainless steel

6.5. Grinder, Ring Mill or Ball Mill (Optional)

6.6. Butcher Paper, Glass Plate or other solid clean surface

6.7. Flat blade or spatula specific for IS sampling

6.8. Oven – A thermostatically controlled chamber capable of maintaining a temperature of 70 + 2°C

6.9. Fume Hood – An enclosed, ventilated, clean bench space with a sash that can be drawn down to increase air-flow across an air-drying sample

7. Reagents and Standards

7.1. Contrex (AP) detergent or other non-Phosphate detergent

7.2. 10% Nitric Acid

7.3. Dichloromethane
7.4. DI Water – Type 1 water from ARI’s centralized water purification system.

8. Sample Collection, Preservation, Shipment and Storage
8.1. Not Applicable

9. Quality Control
9.1. Not Applicable

10. Calibration and Standardization
10.1. Not Applicable

11. Procedure
11.1. Clean and decontaminate equipment using detergent, followed by an acid rinse, DI water rinse, and two rinses of Dichloromethane. Dry thoroughly.
11.2. Remove field samples from storage and check ID numbers. Notify supervisor of any ID discrepancies.
11.3. Fill out data sheet 1149F with job number, technician, date set up, ARI ID number and/or client ID number.
11.4. Lay out the entire field sample on a clean drying tray, with or without clean non-ink paper, and air dry in a fume hood, or oven dry at or below 70°C. The sample is monitored until the sample is dry enough to be screened over a 2mm sieve without material adhering to the screen.
11.5. Sieve the dried sample over a #10 sieve (2 mm) to remove gravel, sticks and other vegetation. Using a stainless steel spoon or fingers, gently break up soil agglomerates and push material through the screen. Mix sieved material prior to next step.
11.6. Lay out the sieved material in a rectangular shape on a flat clean surface (butcher paper, plate glass or drying tray) to a consistent thickness of approximately ½ to 1 inch.
11.7. Roughly divide the spread sample into 30 to 50 subsections. Use a small spatula to collect small but approximately equal sample increments from each of the sections, and place together in clean subsample container on a balance. Be sure to obtain a representative distribution of the material in each sample section, including any fines that might settle to the bottom of the tray/paper. This is best achieved by collection using a flat-bottomed spatula or scoop. The size of sample increments should be designed as appropriate so that 30 to 50 increments will provide the needed subsample mass. As such, the size of each IS sample increment should be 1/30 to 1/50 of the total IS subsample mass. Continue to collect sample increments until the IS subsample achieves targeted sample mass.
11.8. Create a duplicate IS subsample of the same mass, following the same procedure, as a back-up for any laboratory errors.

11.9. Create an additional IS subsample of 15 g to measure the air-dried weight to correct results to the oven-dried weight of the sample, and for analytical screening purposes.

11.10. Label the sample jar as an IS subsample, to assure the entire sample volume is extracted.

11.11. For every 5 to 20 samples per project, a duplicate IS subsample should be created for analysis and quality control evaluation.

11.12. Archive all remaining sample until tests are completed.

12. Data Analysis and Calculations
   12.1. Not Applicable

13. Method Performance
   13.1. Not Applicable

14. Pollution Prevention
   14.1. Do not discard solvent contaminated solid material into trash containers. Place the SPE cartridges in the designated 5-gallon “satellite accumulation station”.
   14.2. Do not discard methylene chloride rinsate into the sink. Pour the waste solvent into the labeled 55-gallon drum located in the Hazardous Waste Storage Area.

15. Data Assessment and Acceptance Criteria for Quality Control Measures
   15.1. Not Applicable

16. Corrective Actions for Out of Control Events
   16.1. Promptly report any events that may compromise the extraction process to the Organic Extractions Supervisor who will take appropriate steps to insure data quality. Corrective actions may include, but are not limited to, notation on the Analyst Notes Form (3056F) or re-extraction of the sample.

17. Contingencies for Handling Out-of-Control or Unacceptable Data
   17.1. Not Applicable

18. Waste Management
   18.1. Discard all waste solvent (Methylene Chloride) into the 55 gallon drum labeled “Chlorinated Solvents” located in the Hazardous Waste Storage Area
18.2. Place samples that designate as hazardous using the LIMS "Hazardous Report" in the designated drum in the Hazardous Waste Storage Area when they are disposed. SOP 1003S describes the process for disposal of samples. Excess extracts and expired spiking solutions must be disposed of in the container labeled "Chlorinated Solvents" located in the Hazardous Waste Storage Area.

18.3. ARI's Laboratory Chemical Hygiene Plan (CHP) describes internal hazardous waste handling procedures. All analysts must be familiar with these requirements.

18.4. ARI properly profiles and disposes all hazardous waste using an EPA registered TSD (Treatment, Storage and Disposal) facility.

19. Method References


Attachment B
Soil Drying Evaluation Memorandum
The Port of Seattle collected pre-confirmation soil samples from nine T-117 confirmation grid cells, as described in the EPA-approved Pre-Confirmation Sampling Quality Assurance Project Plan. Soil was air dried before being passed through a 2-mm sieve and subsampled for analysis. During post-confirmation sampling, rush analysis will be required. Any wet soil, such as that collected from the riverbank face, would need to be dried quickly to facilitate rapid turn-around of data. Therefore, an evaluation of drying method effects on contaminant of concern (COC) loss from soil was conducted.

**Practice Sample**

Pre-confirmation soil samples were collected from three borings advanced in each of nine grid cells. Additionally, a soil sample collected from below the groundwater table (so that the soil is wet) and expected to have high cPAH concentrations was needed for the drying evaluation. Of the soil COCs, only cPAH loss was a concern during expedited drying. The pre-confirmation samples, themselves, are at the bottom of the pre-final design elevations, and thus are expected to be below removal action levels (RvALs). To evaluate cPAH losses, samples having higher concentrations of cPAHs were required, so that if losses occurred during drying, they’d be measurable. Therefore, the “practice sample” soil was collected above the design elevation, in a grid cell (03) with elevated historical cPAH concentrations. Where wet silt was observed above the design elevation (6 ft MLLW) in the three borings from grid cell 03, soil for the practice sample was collected and composited in a quart jar. Soil was collected from anywhere between 6.5 and 8 ft below ground surface, depending upon the boring.

**Drying Evaluation Methods**

The soil from the Practice Sample was divided into three subsamples and dried either by air, by oven at 50°C, or by oven at 70°C. The times required for each sample to be dry enough to pass through a 2-mm sieve were recorded.

Each sample was passed through the sieve and then analyzed for cPAHs in triplicate. Additionally, a matrix spike and matrix spike duplicate from each sample was evaluated for cPAHs.
**Drying Evaluation Results**

Oven drying did not speed up soil drying time substantially, and the lower-temperature oven dried sample actually took more time to dry than the air-dried sample, possibly due to sample heterogeneity. The following durations for the samples to be sievable (as determined by adherence to a spatula) were recorded by the laboratory:

- Air drying: 4 hours
- Oven drying at 50°C: 7.5 hours
- Oven drying at 70°C: 3.5 hours.

cPAHs on a toxicity equivalency basis (the basis of the soil RvAL) were calculated for each of the 9 subsamples from the individual PAH results generated by the laboratory. Within each drying treatment set, the 3 cPAH values were averaged (intra-method variability). The average air dry TEQ was compared to the average TEQ from each oven drying treatment to determine if any cPAH losses occurred from oven drying relative to air drying (inter-method variability, as measured by the relative percent difference; RPD). The RPDs in cPAH TEQs between air and oven drying were 4% and 10% for oven drying at 50°C and at 70°C, respectively (Table 1).

**Conclusion**

Oven drying does not cause loss of cPAHs, and is, thus, acceptable for use during post-confirmation sampling. However, air drying accomplishes sievable soil within a reasonable time frame, such that rapid turn-around analysis can be accomplished with air drying. The pre-confirmation analytical soil samples were dried overnight, beginning at approximately 4:30 pm, and being dried when checked by the technician that next morning at 6:00 am.

Additionally, although historical soil borings in Grid Cell 03 have elevated cPAH concentrations at depths below the groundwater table (up to 760 µg TEQ/kg dw; the RvAL is 140 µg TEQ/kg dw), the cPAH TEQs from this drying evaluation were quite low (ranging from 8 to 16.5 µg TEQ/kg dw). It’s not known how samples with higher concentrations of cPAHs would react to oven drying; however, the post-confirmation data are expected have low cPAH concentrations.
Table 1 cPAH Data from Drying Evaluation

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<tr>
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<td>1 2 3</td>
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<td>Concentration (ppb dw); RL used for ND (U flag)</td>
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<td>11 14 12</td>
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<tr>
<td>dibenzo (a,h) anthracene</td>
<td>1.28 1 1.16</td>
<td>1.12 0.92 0.84</td>
<td>0.92 0.84 1.36</td>
</tr>
<tr>
<td>indeno[1,2,3-cd]pyrene</td>
<td>0.72 0.7 0.64</td>
<td>0.63 0.82 0.68</td>
<td>0.5 0.54 0.69</td>
</tr>
<tr>
<td>total benzofluoranthenes</td>
<td>1.9 1.7 1.6</td>
<td>1.7 1.9 1.6</td>
<td>1.4 1.4 1.5</td>
</tr>
<tr>
<td>cPAH TEQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cPAH (ppb dw)</td>
<td>14.5 12.5 13.8</td>
<td>12.1 16.5 13.8</td>
<td>8.2 14.4 14.3</td>
</tr>
<tr>
<td>Evaluation Type Average</td>
<td>13.6</td>
<td>14.1</td>
<td>12.3</td>
</tr>
<tr>
<td>RPD (50°C and 70°C vs. air dry; average TEQs compared)</td>
<td>4%</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

u = not detected; RPD = relative percent difference.