# Survey Report for
# Sediment Sampling and Analysis at
# Port Orford and Umpqua River Federal Navigation Channels, OR

Contract No. W912DW-12-D-1016-DT01

Port Orford, OR

Umpqua River, OR

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# ACRONYMS, ABBREVIATIONS & INITIALISMS

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| CFR | Code of Federal Regulations |
| CQAR | Chemical Quality Assurance Report |
| cy | cubic yards |
| DQCR | Daily Quality Control Report |
| EDD | electronic data deliverable |
| EPA, USEPA | U.S. Environmental Protection Agency |
| ERL | effects range-low |
| FDA | U.S. Food and Drug Administration |
| GPS | global positioning system |
| HMW | high molecular weight |
| LMW | low molecular weight |
| MB | method blank |
| MDL | method detection limit |
| MLLW | mean lower low water |
| MPRSA | Marine Protection, Research, and Sanctuaries Act of 1972 |
| MRL | method reporting limit |
| MTC | Materials Testing Consultants |
| MTS | Marine Taxonomic Services, LTD |
| NAD 83 | North American Datum 1983 |
| ODMDS | ocean dredged material disposal site |
| PAH | polynuclear aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| QA/QC | quality assurance/quality control |
| RM | River Mile |
| SAP | Sampling and Analysis Plan |
| SEF | 2016 Sediment Evaluation Framework |
| SQL | sample quantitation limit |
| TBT | tributyltin |
| TOC | total organic carbon |
| TPH | total petroleum hydrocarbon |
| USACE | U.S. Army Corps of Engineers |
| USCS | Unified Soil Classification System |

# 1 INTRODUCTION

## 1.1 Project Location and Description

U.S. Army Corps of Engineers (USACE) – Portland District routinely dredges several projects on the Oregon coast and Columbia River to maintain their federally authorized navigation channels. USACE conducts sediment sampling and analysis for these projects prior to dredging to determine suitability for unconfined in-water disposal of dredged sediments and for aquatic exposure of the new surface material.

### 1.1.1 Port Orford

Port Orford is in Curry County, Oregon, approximately 250 miles south of the Columbia River. The harbor is a natural cove protected from the north and west by a headland that extends seaward on a southerly direction for approximately 1 mile.

The Port Orford project was authorized by the Rivers and Harbors Act of 1965 and 1970. The project was further modified by the Water Resources Development Act of 1992. The nearshore and breakwater disposal sites are authorized by Section 404 of the Clean Water Act of 1977 and in accordance with 33 CFR parts 335-338.

The federally authorized project includes a breakwater that is 550 feet long and a turning basin that is 16 feet deep, 90 feet wide, and 750 feet long. The breakwater was constructed in 1935 at the southern end of the cove and extended in 1968 to its current length of 550 feet. The turning basin was constructed to the east of an existing dock in 1971 to provide adequate depths for navigation in the harbor behind the extended breakwater.

Sediment shoaling increased due to the extension of the breakwater, and dredging of the turning basin began in 1971. Since then, the configuration of the turning basin was modified to include a navigation channel between the dock and turning basin. The turning basin is no longer maintained, but USACE still maintains the navigation channel. Initially, only summer dredging of the navigation channel was performed at Port Orford. The winter dredging of an area adjacent to the boat hoist began in 1988 because summer dredging became insufficient to sustain the port through the winter. Since 2014, the Port of Port Orford has maintained the area adjacent to the boat hoist, pumping the material over the breakwater and into the breakwater placement area.

USACE still dredges the navigation channel between the turning basin and the dock over a 50-day period each summer and places the material in the nearshore placement area, located approximately 200 feet off of the southern end of the breakwater. The channel is dredged to the authorized depth of 16 feet plus 4 feet of advanced maintenance, for a total dredging depth of 20 feet. An additional 3 feet of sediment may be disturbed during dredging activities, for a total depth of 23 feet. This practice provides access to boat hoists located at the existing dock and ensures that the authorized depth is maintained between dredging operations.

**Table 1-1** lists recent USACE disposal events at the Port Orford nearshore disposal site.

**Table 1-1. Port Orford Disposal History (2006-2015)**

| Calendar Year | Dredge | Quantity (cy) | Placement Method | Placement Site |
|---|---|---|---|---|
| 2015 | *WJ Marston* | 14,445 | Scow | Nearshore Site |
| 2014 | *Sea Horse* | 27,899 | Scow | Nearshore Site |
| 2014 | *Sea Horse* | 6,876 | Scow | Nearshore Site |
| 2014 | Toyo Pump | 3,916 | Pipeline | Breakwater |
| 2014 | Toyo Pump | 2,881 | Pipeline | Breakwater |
| 2013 | ---------- | | | |
| 2012 | ---------- | | | |
| 2011 | ---------- | | | |
| 2010 | Contract Clamshell | 23,104 | Clamshell | Nearshore Site |
| 2009 | Contract Clamshell | 23,548 | Clamshell | Nearshore Site |
| 2008 | ---------- | | | |
| 2007 | Contract Clamshell | 30,961 | Clamshell | Nearshore Site |
| 2007 | Contract Hoist | 4,531 | Toyo/Pipeline | Breakwater |
| 2006 | Contract Hoist | 4,000 | Toyo/Pipeline | Breakwater |

In 2006, the nearshore placement area was doubled in size from 400 feet by 400 feet to 800 feet by 800 feet to increase dredged material placement capacity. The smaller configuration had a maximum annual capacity of 30,000 cy of dredged material. Surveys in 2006 indicated that approximately 45,000 cy of material needed to be dredged from the project area.

Placement at the nearshore site by a clamshell contractor (HME Construction, Inc.) in 2014 and 2015 resulted in mounding in the placement area. The mounding in 2014 was not substantiated by surveys, but was a navigation concern to the local users. Mounding in 2015 was not critical, but was observed in USACE's hydrographic surveys. Further, mounding made disposal operations difficult and limited the dredging contractor's ability to spread the material evenly across the site.

USACE is proposing to double the size of the current nearshore placement area. A larger placement area with more cells will allow USACE to better manage the site and place dredged material more evenly to prevent mounding.

Coarse-grained material (mostly sand and some gravel; <5% fines) from the federal channel was last placed at the nearshore site in September 2015. As of May 2016, USACE hydrographic surveys show the nearshore placement area to be gently sloping from a depth of approximately 27 feet to 44 feet.

### 1.1.2 Umpqua River

The mouth of the Umpqua River is 180 miles south of the Columbia River in Oregon's mid coastal region. The Umpqua drainage system covers 4,560 square miles. The river originates in the Cascade Mountains and delivers 6,700,000 acre-feet annually to the Pacific Ocean. The estuary of the Umpqua covers approximately 6,430 acres and is the third largest in Oregon. Tidal water can extend up the river to the town of Scottsburg at River Mile (RM) 27.5.

The authorized federal project includes two jetties at the entrance and an 11.4-mile federal navigation channel. The north jetty is 8,000 feet long and the south jetty is 4,200 feet long. The authorized entrance channel is 26 feet deep and 400 feet wide between RM-1 and RM 0-10. The federal navigation channel is 22 feet deep and 200 feet wide and extends from RM 0-10 to RM 11.4 at Reedsport. The turning basin at Reedsport is 22 feet deep, 600 feet wide, and 1,000 feet long. Another side channel near RM 8 provides access to Gardiner and is 22 feet deep and 200 feet wide. The turning basin at Gardiner is authorized to 22 feet deep, 500 feet wide, and 800 feet long. The Gardiner channel and turning basin are not currently maintained to these dimensions. The Gardiner channel is infrequently maintained to a depth of 18 feet.

Two adjacent but unconnected boat basins are located at Winchester Bay (Salmon Harbor) near RM 1.5. Federal access channels to these boat basins are authorized at 16 feet deep and 100 feet wide. The East Basin channel is 16 feet deep by 100 feet wide for 3,100 feet; 16 feet deep by 100 feet wide for 500 feet; and 12 feet deep by 75 feet wide for 950 feet (for a total 4,500 feet). The West Basin is 16 feet deep, 100 feet wide, and 4,300 feet long. Up to 100,000 cy of material is removed from the federal navigation channel and up to 25,000 cy of material is removed from the Winchester Bay boat basin access channels annually.

## Previous Testing/Site History

On August 31, 2011, a total of 12 samples from 10 locations were collected from the Umpqua River federal project. Six grab samples were collected from the Umpqua River federal navigation channel and two grab samples were collected from the Gardiner channel (eight samples total). Two cores of fine-grained sediment were collected from the Winchester Bay boat basin access channel. The cores were divided into dredge prism (A layer) and new surface material (Z layer) samples (four samples total). All 12 samples were submitted for physical analysis. The four core samples and one of the grab samples from the Gardiner channel were also submitted for chemical analysis. None of the samples exceeded marine sample quantitation limits (SQLs). The following bioaccumulative chemicals of concern were not detected: polychlorinated biphenyls (PCBs), pesticides, and tributyltin. Mercury was detected at concentrations well below the 2016 Sediment Evaluation Framework (SEF) marine SQL. The surface grab samples are not sufficient to characterize the entire 15 feet of dredge prism material found in the Gardiner turning basin. Core sampling of the dredge prism and new surface material would need to be conducted to fully characterize this portion of the project prior to maintenance dredging to the authorized depth.

**Table 1-2** summarizes Umpqua River dredging and disposal volumes from 2006 through 2015.

**Table 1-2. Umpqua River Dredging and Disposal 2006-2015**

| Calendar Year | Month | Dredge | Quantity (CY) | Placement Method | Placement Site |
|---|---|---|---|---|---|
| 2015 | October | *Yaquina* | 50,942 | Hopper | NUROS |
| 2015 | September | *Yaquina* | 16,859 | Hopper | 0.8-IW |
| 2015 | September | *Yaquina* | 34,483 | Hopper | NUROS |
| 2015 | August | *Yaquina* | 35,019 | Hopper | NUROS |
| 2015 | July | *Yaquina* | 33,968 | Hopper | NUROS |
| 2015 | July | *Yaquina* | 5,175 | Hopper | 0.8-IW |
| 2014 | September | *Yaquina* | 80,406 | Hopper | ODMDS |
| 2014 | August | *Heidi Renee* | 17,693 | Scow | ODMDS |
| 2014 | August | *Heidi Renee* | 8,610 | Scow | 0.8-IW |
| 2014 | August | *Yaquina* | 33,643 | Hopper | ODMDS |
| 2014 | August | *Yaquina* | 333 | Hopper | 0.8-IW |
| 2014 | July | *Yaquina* | 55,252 | Hopper | ODMDS |
| 2013 | October | *Yaquina* | 93,029 | Hopper | NUROS |
| 2013 | October | *Yaquina* | 3,039 | Hopper | 0.8-IW |
| 2013 | September | *Yaquina* | 19,908 | Hopper | NUROS |
| 2013 | September | *Yaquina* | 3,961 | Hopper | 0.8-IW |
| 2012 | September | *Yaquina* | 50,298 | Hopper | UROS |
| 2012 | September | *Yaquina* | 8,276 | Hopper | IW-0.8 |
| 2012 | July | *Yaquina* | 56,037 | Hopper | UROS |
| 2011 | August | *Yaquina* | 990 | Hopper | IW-0.8 |
| 2011 | August | *Yaquina* | 133,137 | Hopper | NUROS |
| 2010 | August | *Yaquina* | 17,619 | Hopper | IW-0.8 |
| 2010 | August | *Yaquina* | 113,426 | Hopper | NUROS |
| 2010 | August | Contractor Clamshell | 30,623 | Clamshell | IW-0.8 |
| 2009 | September | *Yaquina* | 46,843 | Hopper | 0.8-IW |
| 2009 | September | *Yaquina* | 60,570 | Hopper | UROS |
| 2008 | Oct/Nov | Contractor Clamshell | 16,204 | Clamshell | IW-0.8 |
| 2008 | August | *Yaquina* | 29,090 | Hopper | IW-0.8 |
| 2008 | August | *Yaquina* | 64,742 | Hopper | UROS |
| 2007 | September | *Yaquina* | 4,096 | Hopper | 0.8-IW |
| 2007 | August | Contractor Clamshell | 19,439 | Clamshell | 0.8-IW |
| 2007 | August | Contractor Clamshell | 10,934 | Clamshell | ODMDS |
| 2007 | August | *Yaquina* | 80,357 | Hopper | UROS |
| 2007 | June | *Yaquina* | 13,499 | Hopper | UROS |
| 2006 | August | *Yaquina* | 18,936 | Hopper | UROS |
| 2006 | July | *Yaquina* | 43,049 | Hopper | UROS |

## 1.2 Project Objectives

### 1.2.1 Port Orford

Sampling is being conducted in Port Orford for the purpose of expanding the existing nearshore disposal site. The objectives of this study are to:

- Characterize the grain size of sediments placed within the nearshore disposal site for comparison to reference sites outside of the disposal site.
- Document the benthic community within the disposal site for comparison outside the disposal site, in the area of the proposed site expansion. This information is provided in a separate report.

### 1.2.2 Umpqua River

The objective of this sediment characterization effort is to document that sediment physical and chemical properties established in prior sampling events are similar to prior characterizations.

- Characterize sediments in accordance with the regional dredged material testing protocols found in the 2016 SEF (RSET 2016).
- Collect, handle, and analyze representative sediment from the USACE projects in accordance with protocols and quality assurance/quality control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of suitability of unconfined aquatic placement and unconfined aquatic exposure.
- Analyze for physical and chemical parameters as outlined in the 2016 SEF and described in Section 5 of the Sampling and Analysis Plan (SAP). Laboratory methods and sample quantitation limits appear in Appendix A of the SAP and conform with the 2016 SEF, Table 6-2.

### 1.2.3 Project Deliverables

USACE subcontracted ANAMAR to collect sediment samples, conduct required analyses, and present the results in a report. The field effort, laboratory methods, and this report are in accordance with the performance work statement (PWS) and the SAP **(Appendix A)**.

Deliverables associated with this project include:

- Field Survey Summary Report, including copies of
  - Field Survey Logs
  - Daily Quality Control Reports (DQCRs)
- Laboratory electronic data deliverables and report in a format suitable for entry into the Washington Department of Ecology's EIM database
- Chemical Quality Assurance Report (CQAR)
- Benthic and epibenthic report (for Port Orford only), provided separately

ANAMAR coordinated and directed operations for this project and worked closely with USACE and our subcontractors to develop a sampling and analysis scheme, schedule, and deliverables. ANAMAR also reviewed all data and produced this report summarizing the results of the physical and chemical testing of project sediment samples collected from Port Orford and Umpqua River project areas. Marine Taxonomic Services, LTD (MTS) will prepare a separate report summarizing results for the benthic and epibenthic data from Port Orford. **Table 1-3** indicates the duties and responsibilities of USACE, ANAMAR, and the subcontractors.

**Table 1-3. Duties and Responsibilities Associated with This Project**

| Company, Location, Website | Area(s) of Responsibility |
|---|---|
| U.S. Army Corps of Engineers, Portland District | Preparation of PWS and SAP, participation/supervision of sampling effort, technical review and approval of submittals |
| ANAMAR Environmental Consulting, Inc. | Prepare project deliverables, lead field sampling effort, lab coordination, project management |
| Marine Taxonomic Services, LTD (MTS) | Field and vessel support, benthic/epibenthic sample analysis and reporting |
| ALS Environmental | Laboratory preparation and chemical analysis of sediment samples; sample holding and archiving |
| Materials Testing Consultants (MTC) | Physical analysis of sediment samples |

# 2 MATERIALS AND METHODS

## 2.1 Project Design and Rationale

A PWS and a SAP were prepared by USACE detailing the sampling design and rationale, analysis, and reporting requirements for both project areas. Copies of these documents are provided in **Appendix A**.

### 2.1.1 Sampling Scheme and Locations

Sampling locations within both project areas were selected by USACE and were distributed to provide adequate representation for each sampling reach/area. Sample locations for Port Orford and Umpqua River are shown in **Maps 1 through 3** (included at the end of this section). Summaries of the sampling scheme including field sampling methods, target coordinates, analyses, sampling compositing scheme, and sample nomenclature for Port Orford and Umpqua River, are provided in **Tables 2-1 and 2-2**, respectively.

### 2.1.2 Sample Analysis

This section summarizes the analytical scheme for samples collected from Port Orford and the Umpqua River. All analyses were conducted in accordance with Table 6-2 of the 2016 SEF.

#### 2.1.2.1 Physicals and Conventionals

Sediment grab samples collected from Port Orford and Umpqua River were analyzed for grain size and conventional parameters, as stated below. The sampling scheme is summarized in **Tables 2-1 and 2-2.**

- Port Orford – Grain size and TOC (all samples)
- Umpqua River – Grain size and TOC (all samples); Conventionals - Total Solids (%), Total Sulfides, and Ammonia (UMP-VC-01 and UMP-VC-02)

#### 2.1.2.2 Chemicals of Concern

Sediment samples (UMP-VC-01 and UMP-VC-02) were submitted for analysis of the following analytes:

- Metals: Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Silver (Ag), and Zinc (Zn)
- Polynuclear Aromatic Hydrocarbons (PAHs)(Low-molecular Weight and High-molecular Weight)
- Chlorinated Hydrocarbons
- Phthalates
- Phenols
- Miscellaneous Extractable Compounds
- Pesticides
- PCBs
- Bulk Tributlytin (TBT)
- Total Petroleum Hydrocarbons (TPHs) (NW-HCID Screen, with Follow-up)
  - Total Petroleum hydrocarbon (TPH)-Diesel
  - TPH-Residual

#### 2.1.2.3 Benthic and Epibenthic Analysis

**Benthic Grab Samples**

Ten benthic grab samples were collected, processed, and preserved at the Port Orford site. Samples were taken back to the MTS laboratory for analysis. The samples were sorted into four groups: polychaetes, mollusks, crustaceans, and miscellaneous. The groups were identified to the lowest practical taxa and counted. Other data to be recorded included species density, diversity, richness, and equitability within and outside the disposal site.

**Epifaunal Trawl Samples**

Three 10-minute trawls were performed within the existing and expanded sites. Samples from the trawls were sorted and the epibenthic fauna were identified to the lowest practical taxa.

Benthic and epifaunal results will be summarized and discussed in a separate report prepared by MTS.

**Table 2-1. Port Orford Sampling Scheme**

| Location | Station ID | Sample ID | Target Coordinates (as proposed in SAP) | | Sample Types | Analysis |
|---|---|---|---|---|---|---|
| | | | Lat | Long | | |
| Port Orford Outside Existing Site | PO-01 | PO-01 | 42.7362 | -124.4982 | grabs | Physical + TOC + Benthic |
| | PO-02 | PO-02 | 42.7365 | -124.4938 | grabs | Physical + TOC + Benthic |
| Port Orford Outside Expanded Site | PO-03 | PO-03 | 42.7337 | -124.4979 | grabs | Physical + TOC + Benthic |
| | PO-04 | PO-04 | 42.7340 | -124.4934 | grabs | Physical + TOC + Benthic |
| Port Orford Inside Existing Site | PO-05 | PO-05 | 42.7369 | -124.4962 | grabs | Physical + TOC + Benthic |
| | PO-06 | PO-06 | 42.7362 | -124.4961 | grabs | Physical + TOC + Benthic |
| | PO-07 | PO-07 | 42.7354 | -124.4960 | grabs | Physical + TOC + Benthic |
| Port Orford Inside Expanded Site | PO-08 | PO-08 | 42.7345 | -124.4958 | grabs | Physical + TOC + Benthic |
| | PO-09 | PO-09 | 42.7338 | -124.4957 | grabs | Physical + TOC + Benthic |
| | PO-10 | PO-10 | 42.7332 | -124.4956 | grabs | Physical + TOC + Benthic |
| Port Orford Inside Existing Site | PO-A1 start | PO-A-Trawl | 42.7363 | -124.4973 | trawl | Epibenthic |
| | PO-A2 stop | | 42.7365 | -124.4949 | | |
| Port Orford Inside Expanded Site | PO-B1 start | PO-B-Trawl | 42.7345 | -124.4970 | trawl | Epibenthic |
| | PO-B2 stop | | 42.7348 | -124.4946 | | |
| | PO-C1 start | PO-C-Trawl | 42.7331 | -124.4968 | trawl | Epibenthic |
| | PO-C2 stop | | 42.7333 | -124.4944 | | |

Note: Coordinates as sampled in the field are provided in **Appendix B.**

**Table 2-2. Umpqua River Sampling Scheme**

| Location | Subsample ID | Composite/ Final ID | Target Coordinates (as provided in SAP) | | Sample Types | Project Depth (ft, MLLW) | Est. Bottom Elevation (MLLW, based on bathy) | Analysis |
|---|---|---|---|---|---|---|---|---|
| | | | Lat | Long | | | | |
| Umpqua River Ent to RM 0-45 | UMP-PG-01 | UMP-PG-01 | 43.66783 | -124.21878 | grabs | | | Physical + TOC |
| Umpqua River RM 4+10 | UMP-PG-02 | UMP-PG-02 | 43.71517 | -124.15452 | grabs | | | Physical + TOC |
| Umpqua River RM 6+10 | UMP-PG-03 | UMP-PG-03 | 43.73629 | -124.16258 | grabs | | | Physical + TOC |
| Umpqua River RM 10+15 | UMP-PG-04 | UMP-PG-04 | 43.71520 | -124.11285 | grabs | | | Physical + TOC |
| Umpqua River Gardiner Channel/RM 8+20 | UMP-PG-05 | UMP-PG-05 | 43.74481 | -124.12711 | grabs | | | Physical + TOC |
| | UMP-VC-01 | UMP-VC-01A | 43.74078 | -124.12133 | Vibracore A layer | -18 | Vibracore A layer -17 to -18 MLLW | Physical + Conventionals + Chemistry |
| | | UMP-VC-01Z | | | Vibracore Z layer | -18 | Vibracore Z layer -18 to -22 MLLW | Physical + Conventionals + Chemistry |
| Umpqua River Gardiner Turning Basin/RM 9 | UMP-PG-06 | UMP-PG-06 | 43.73201 | -124.11488 | grabs | | | Physical + TOC |
| | UMP-VC-02 | UMP-VC-02A | 43.73542 | -124.11605 | Vibracore A layer | -18 | Vibracore A layer -16 to -18 MLLW | Physical + Conventionals + Chemistry |
| | | UMP-VC-02Z | | | Vibracore Z layer | -18 | Vibracore Z layer -18 to -22 MLLW | Physical + Conventionals + Chemistry |
| Umpqua River Boat Basin East and West | UMP-PG-07 | UMP-PG-07 | 43.67626 | -124.17878 | grabs | | | Physical + TOC |
| | UMP-PG-08 | UMP-PG-08 | 43.67704 | -124.18256 | grabs | | | Physical + TOC |
| | COMP 7 and 8 | UMP-COMP-01 | N/A | | | | | Conventionals (**minus TOC**) + Chemistry |

MLLW = mean lower low water
Note: Coordinates as sampled in the field are provided in **Appendix B**.
Note: Z layer samples were not collected. See Section 2.2.5.1 and Section 4.1 for details.

## 2.2 Field Operations and Methods

### 2.2.1 Field Team and Responsibilities

Field personnel consisted of a field team leader from ANAMAR, scientists and vessel operator from MTS, and two lead technical staff from USACE Portland. **Table 2-3** summarizes the project team and their duties and responsibilities for the sediment sampling project at the Port Orford and Umpqua River federal navigation projects.

**Table 2-3. Project Team and Responsibilities**

| Task/Responsibility | USACE | ANAMAR/MTS (Contractors) |
|---|---|---|
| Sampling Plan Prep | X | |
| Sampling Plan Review | X | X |
| Field Sampling | X | X |
| Sediment Analysis/Lab Coordinator | | X |
| Benthic/Epibenthic Species ID and Field Survey Summary Reports | | X |
| Data QA/QC | | X |
| Technical Review | X | X |

**ANAMAR Duties (Prime Contractor)**

- ANAMAR provided a senior field scientist to coordinate field logistics and field equipment/supplies, prepare field notebooks and sample kits, and oversee the subcontractors while performing sampling.
- ANAMAR performed sample collection and coordinated with MTS, MTC, and ALS Environmental regarding sample analysis and data deliverables.
- ANAMAR recorded sample locations and depths in the field and documented field activities on field logs.
- ANAMAR retained custody of samples throughout the field effort and ensured that samples were labeled, stored, and transported properly.
- ANAMAR performed QA/QC on all laboratory data to ensure compliance with quality assurance guidelines.
- ANAMAR prepared this survey report that summarizes the methods used for sample collection and results of physical and chemical analysis.

**MTS Duties (Subcontractor)**

- MTS provided the vessel and operator, vibracore equipment and operator, and benthic and epibenthic sampling equipment and analysis.
- MTS provided benthic and epibenthic species ID and a summary report of results (provided as a separate report).

**Laboratory Duties (Subcontractor)**

- Laboratories (MTC and ALS) provided sample containers, coolers, labels, custody tape, and chain-of-custody forms.
- Laboratories analyzed samples according to methods and QA criteria stated in Table 6-2 of the 2016 SEF.

Laboratories submitted an electronic data deliverable (EDD), including QC data, of the sediment quality data suitable for entry into the Washington Department of Ecology's EIM database.

### 2.2.2 Summary of Field Operations

Field sampling took place at Port Orford on August 20, 2016, and on August 23 and 24, 2016, for the Umpqua River area. These two sampling efforts were combined with three other locations under a separate task order (Chetco River, Coquille River, and Siuslaw River) to save on mobilization costs. Sampling activities were conducted according to the SAP and PWS (**Appendix A**), 2016 SEF, and guidance from USACE staff. Any deviations from the sampling plan are documented in the DQCR and are summarized in Section 4. A summary of field sampling activities is provided in **Table 2-4**. A copy of the DQCRs are provided in **Appendix B**.

**Table 2-4. Field Sampling Activities**

| Date | General Activity |
|---|---|
| 19-Aug-2016 | • Field sampling team mobilizes to Brookings, OR. |
| 20-Aug-2016 | • Sample Port Orford. Collected sediment/benthic grabs samples from stations PO-01 through PO-10. Collected and processed epifaunal samples from Trawls PO-A through PO-C. |
| 21-Aug through 22-Aug 2016 | • Collected samples from Chetco River and Coquille River (not part of this report/task order). Packed and shipped Port Orford samples to the laboratory via FedEx. |
| 23-Aug-2016 | • Collected grab and vibracore samples (UMP-PG-04 through 06, UMP-VC-01, and UMP-VC-02) from the upper part of the Umpqua River near Reedsport. |
| 24-Aug-2016 | • Collected grab samples (UMP-PG-01 through 03, UMP-PG-07, and UMP-PG-08) from the entrance channel, river stations, and boat basins east and west near Winchester. |
| 25-Aug-2016 | • Collected samples from Siuslaw River (not part of this report/task order). End sampling operations.<br>• Packed and iced all samples, prepared chains of custody. Wendy Briner (USACE) took custody of samples and transported them to Portland. |
| 26-Aug-2016 | • ALS retrieved chemistry samples by courier from USACE Portland office. |
| 29-Aug-2016 | • Physical samples shipped to MTC via FedEx. |

### 2.2.3 Site Positioning

The latitude and longitude of each target sample location were provided by USACE and are listed in **Tables 2-1 and 2-2**. Horizontal coordinates were referenced to the Oregon Coordinate System for proper North or South Zones NAD 83 (North American Datum 1983). Horizontal coordinates were identified as latitude and longitude to the 0.0001 degree. Target coordinates were uploaded to a Panasonic Toughbook computer on the MTS research vessel as well as on a Garmin Dakota hand-held GPS (used as a backup unit). Uploaded coordinates were reviewed and compared with the original coordinates to verify prior to field sampling. All samples were taken within 50 feet of the target station. Navigation and positioning of the vessel were handled by MTS under direction of the ANAMAR field team leader. Hard copies of field maps were available in the field to aid with navigation and to confirm sampling locations.

Actual sampling locations were recorded in the field (both on the computer and with the handheld GPS) each time the sampler was deployed. The sampling team used local tidal and staff gauge data and the depth finder on the sampling vessel to determine the sample depth and

tide-corrected mudline elevation. Water depths during sampling were determined using a graduated line except when water currents were too strong for an accurate reading with this method, in which case the vessel's fathometer was used. This information was recorded on the field sheets. Actual sample locations are depicted on **Maps1 through 3**. Copies of field sheets and a spreadsheet with actual sample coordinates are provided in **Appendix B**.

### 2.2.4 Decontamination Procedures

All sampling devices, trays, bowls, and utensils were thoroughly decontaminated prior to use according to the following procedure.

Decontamination Procedures

- Rinse with site water
- Wash with brush and Alconox® soap
- Rinse with distilled water
- Equipment not being used immediately was air-dried and stored wrapped in new, clean aluminum foil

All utensils and samplers used to collect chemical samples were decontaminated prior to each station. All handwork for chemical analyses was conducted with disposable nitrile gloves. Gloves were changed between subsample stations and as needed to prevent cross-contamination. Utensils and equipment used to collect physical samples only were rinsed with site water and did not require the full decontamination procedure.

### 2.2.5 Sediment Sampling Methods

At all sampling stations, once the vessel was on the target station and immediately before collecting the sample, the water depth was recorded and the tide table was consulted to determine the depth to mudline. A GPS coordinate was taken each time the sampler was deployed. Once the sampler was back on board, the acceptability of the sample was determined. Samples with minimal evidence of leakage or winnowing were acceptable. If the sample was acceptable, it was placed in a stainless steel pan until adequate volume was collected for sample analysis. When adequate volume was achieved, a picture of the sample with a labeled photocard was taken. Then, the sample was homogenized using a stainless steel utensil. Samples for chemical analysis were placed in pre-labeled, clean glass jars provided by the laboratory. Samples were stored in coolers on wet ice to maintain the ≤4°C holding temperature. Samples for physical analysis were placed in labeled, double-bagged zip-closure freezer bags and duct-taped closed to prevent leakage.

Each subsample was photographed. All sample logs included the following information:

- Sample acceptability and number of successful/failed attempts per station
- Physical sediment description (includes apparent grain size, density/consistency, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Stratification and/or unique lenses of material
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen

- Any other distinguishing characteristics or features

Copies of the field sheets are provided in **Appendix B**. Photographs of the samples are provided in **Appendix F**.

#### 2.2.5.1 Sediment Sampling with Vibracore

Two stations (UMP-VC-01 and UMP-VC-02) in the Umpqua River Gardiner Channel project area required collection using a vibracore for A layer and Z layer characterization. The sampling methods followed those outlined in Section 4.6 of the SAP; however, the material was very sandy at both stations and most of the sample was lost upon retrieval on each attempt. The core sampler only retained approximately 1 foot of sediment (A layer). Therefore, due to consistently poor recovery on all attempts (<50%), USACE personnel decided to switch to the Ponar grab sampler to collect adequate volume at these stations for analysis of the A layer.

#### 2.2.5.2 Sediment Sampling with Grab Sampler

Grab samples were collected from Port Orford and Umpqua River project areas with a Ponar dredge-type grab sampler. The sampling methods followed those outlined in Section 4.6 of the SAP. The sampling device was lowered and raised by a winch from the side of the vessel. Excess water was allowed to drain from the sampler prior to placing the sediment in the bin. Each sample was inspected for acceptability (winnowing, leakage, or overfill) prior to placing in a stainless steel pan. Sample handling and documentation followed methods described in Section 2.2.5.

Benthic grab samples were washed through a 0.5-mm mesh box sieve and the retained material was placed in a plastic container and fixed with a 10% solution of buffered formalin and sea water for transport to the laboratory. MTS sorted the samples under a microscope into four groups: polychaetes, mollusks, crustaceans, and miscellaneous. The groups were identified to the lowest practical taxa and counted. Other data recorded included species density, diversity, richness, and equitability within and outside the disposal site.

### 2.2.6 Trawling Methods

Trawls were conducted along three transects within the Port Orford placement site and proposed expansion area. Trawls were conducted using a 12-foot semi-balloon otter trawl with a ¼-inch mesh liner. The trawl was lowered to the seafloor off the back of the vessel and was towed along transects as shown on **Map 1** for approximately 3 minutes each.

Upon retrieval of the trawl, the contents were removed from the bag end of the trawl, sorted, and placed into open-top containers. Fresh seawater was added to the containers to maintain dissolved oxygen levels for the captured animals.

When possible, the fish and invertebrates were sorted, identified, measured, and returned to the sea. Fish length was also recorded. Any individuals that could not be immediately identified were preserved and identified later in the laboratory. These specimens were placed into an appropriate-sized container and preserved in a solution of 10% buffered formalin and seawater solution and delivered to the MTS laboratory.

### 2.2.7 Sample Transport and Custody

After sample containers were filled, all samples were placed on wet ice in coolers. Prior to shipping, chain-of-custody forms were filled out for each project area and for each laboratory receiving samples. Chain-of-custody forms were enclosed in a plastic bag and placed inside

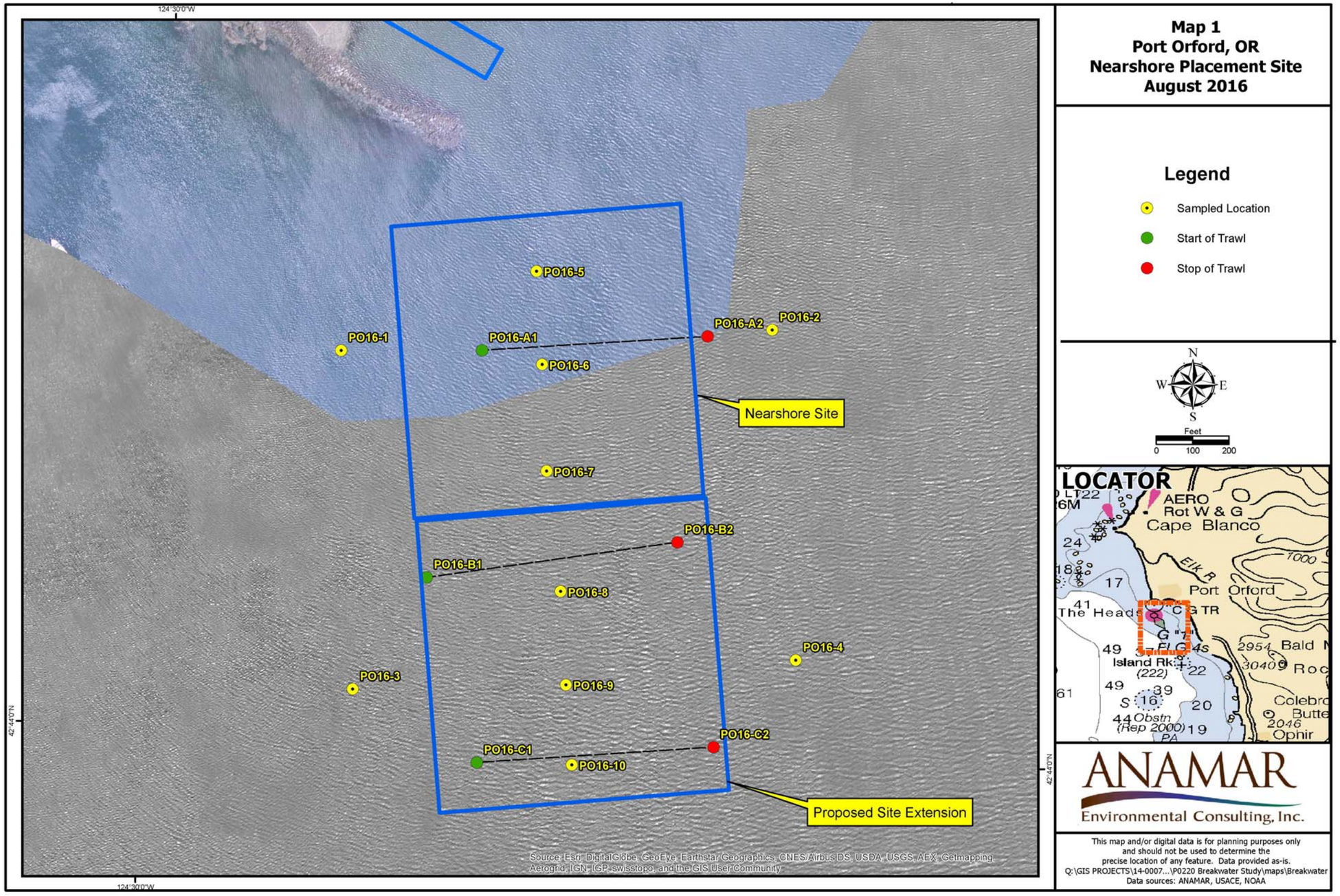
the coolers. Samples were packaged to prevent breakage during shipping and were shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 173.24 or delivered directly to the testing laboratory via courier. Upon transfer of sample possession to the laboratory, the person transferring custody of the coolers signed the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers were inspected and the receiver recorded the condition of the samples. ANAMAR confirmed with the laboratories that all samples arrived in good condition and as stated on the chain-of-custody form.

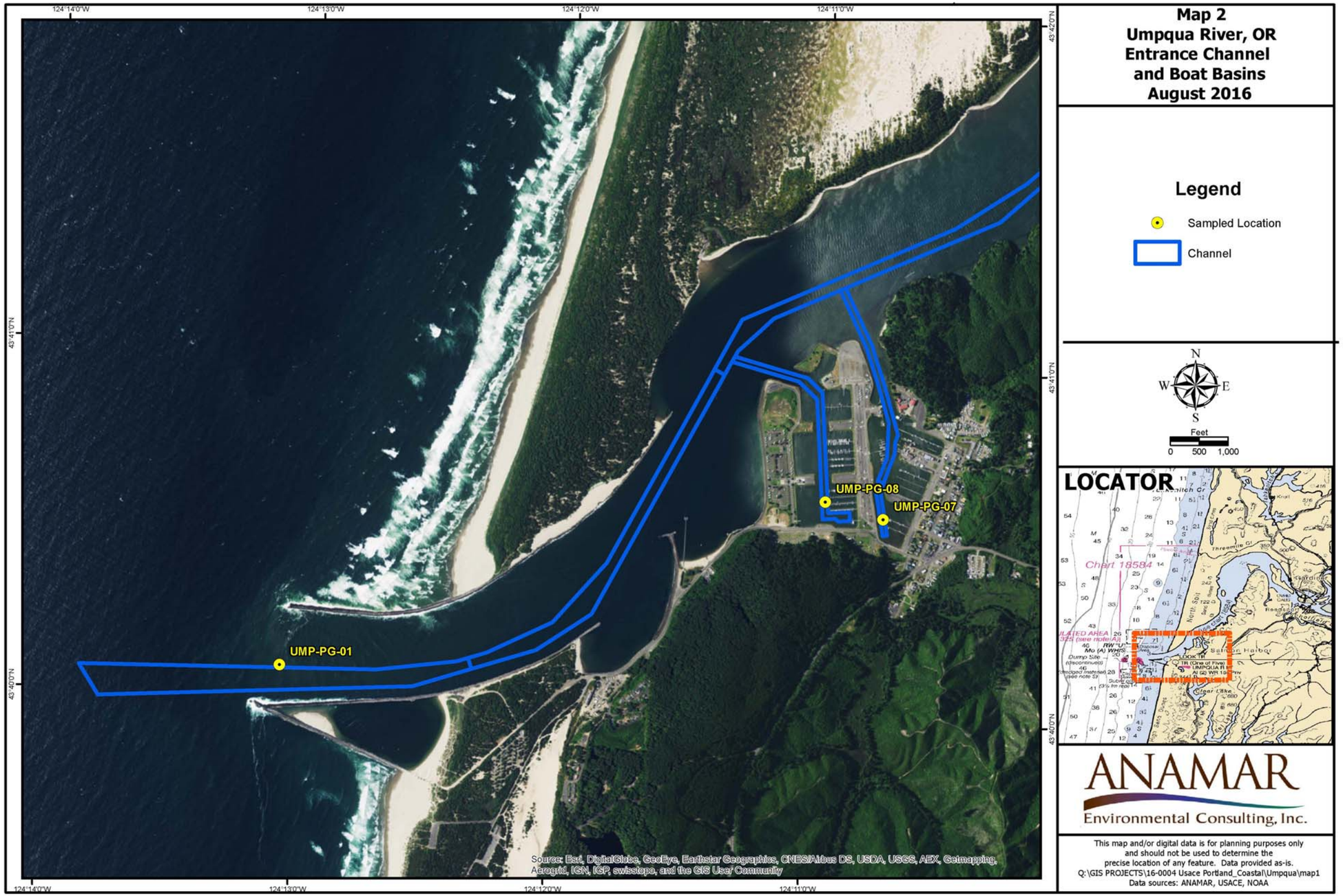
## 2.3 Laboratory Analysis

Laboratory testing procedures for chemical and physical parameters were conducted in accordance with the 2016 SEF. The samples were analyzed for the parameters listed in Section 2.1.2 (and summarized in **Tables 2-1 and 2-2**), as requested on the chain-of-custody record. MTC conducted all physical analyses, and ALS Environmental conducted all conventionals and chemical analyses.

All reasonable means, including additional cleanup steps and method modifications, were used to meet target levels. Detection of analytes between the method reporting limit (MRL) and the method detection limit (MDL) are "J" flagged and reported as an estimate. All analytes should meet quantitation limits listed in Table 5-1 of the 2016 SEF, which provides the sediment preparation and analysis methods and sample quantitation limits (i.e., MRLs) required. For undetected chemicals, the laboratory was required to achieve MDLs or limits of detection below the 2016 SEF marine benthic toxicity screening limits (SLs). Any instance for which the laboratory was unable to achieve sufficiently low MDLs for particular analytes are identified in ALS Environmental's case narrative (**Appendix E**), and summarized in Section 4 and the CQAR (**Appendix D**).

Section 5 of the SAPs provides additional information on holding times, QA/QC procedures, and reporting guidelines. Copies of the SAPs are provided in **Appendix A**.


124°30'0"W
42°44'0"N
PO16-5
PO16-1
PO16-A1
PO16-A2
PO16-2
PO16-6
Nearshore Site
PO16-7
PO16-B2
PO16-B1
PO16-8
PO16-4
PO16-3
PO16-9
PO16-C2
PO16-C1
PO16-10
Proposed Site Extension
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
124°30'0"W
Map 1
Port Orford, OR
Nearshore Placement Site
August 2016
Legend
Sampled Location
Start of Trawl
Stop of Trawl
N
W
E
S
Feet
0
100
200
LOCATOR
AERO
Rot W & G
Cape Blanco
Port Orford
The Heads
CG TR
Island Rk
(222)
Obstn
(Rep 2000)
PA
Ophir
ANAMAR
Environmental Consulting, Inc.
This map and/or digital data is for planning purposes only
and should not be used to determine the
precise location of any feature. Data provided as-is.
Q:\GIS PROJECTS\14-0007...\P0220 Breakwater Study\maps\Breakwater
Data sources: ANAMAR, USACE, NOAA




**Map 2**
**Umpqua River, OR**
**Entrance Channel**
**and Boat Basins**
**August 2016**

**Legend**

Sampled Location

Channel

N
W E
S

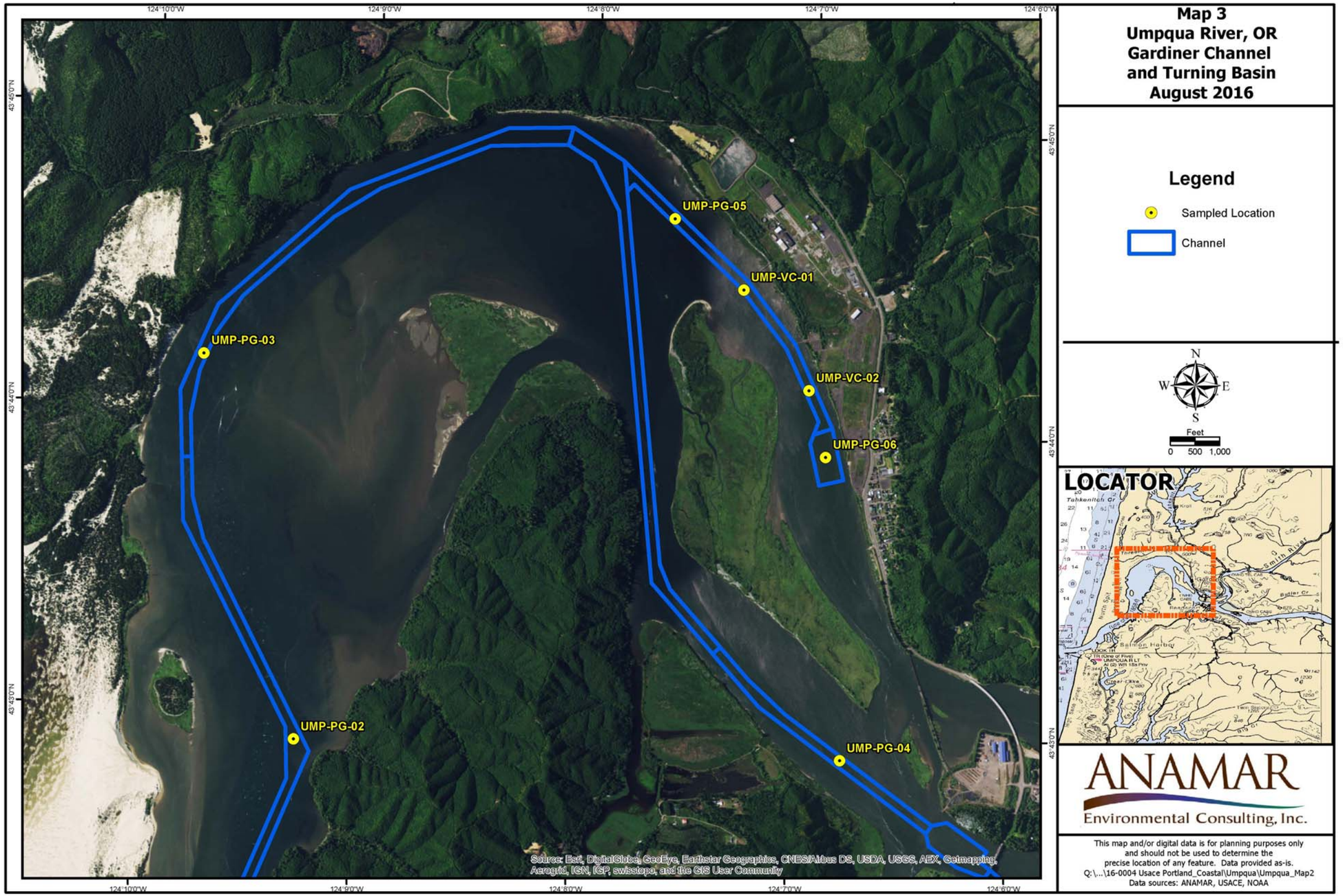
Feet
0 500 1,000

**LOCATOR**




ANAMAR
Environmental Consulting, Inc.

This map and/or digital data is for planning purposes only and should not be used to determine the precise location of any feature. Data provided as-is.
Q:\GIS PROJECTS\16-0004 Usace Portland_Coastal\Umpqua\map1
Data sources: ANAMAR, USACE, NOAA




**Map 3**
**Umpqua River, OR**
**Gardiner Channel and Turning Basin**
**August 2016**

**Legend**

- Sampled Location
- Channel

N
W E
S

Feet
0 500 1,000

**LOCATOR**




ANAMAR
Environmental Consulting, Inc.

This map and/or digital data is for planning purposes only and should not be used to determine the precise location of any feature. Data provided as-is.
Q:\...\16-0004 Usace Portland_Coastal\Umpqua\Umpqua_Map2
Data sources: ANAMAR, USACE, NOAA

# 3 RESULTS AND DISCUSSION

## 3.1 Port Orford Results

Physical, benthic, and epifaunal trawl samples were collected from Port Orford as summarized in **Table 2-1** and shown in **Map 1**. Only physical results are presented in this survey report. Benthic and epifaunal results are provided in a separate report prepared by MTS.

Ten samples for physical and benthic analysis were collected from the Port Orford dredged material placement area. Four reference samples were collected outside the placement area, three samples were collected in the existing nearshore placement area, and three samples were collected in the proposed extension area. Complete results for physical analysis are presented in the laboratory reports provided in **Appendix C.** Percent grain size distribution is presented in **Figure 3-1**. All of the samples consisted of predominately sand ranging from 93.7% to 97.8%.

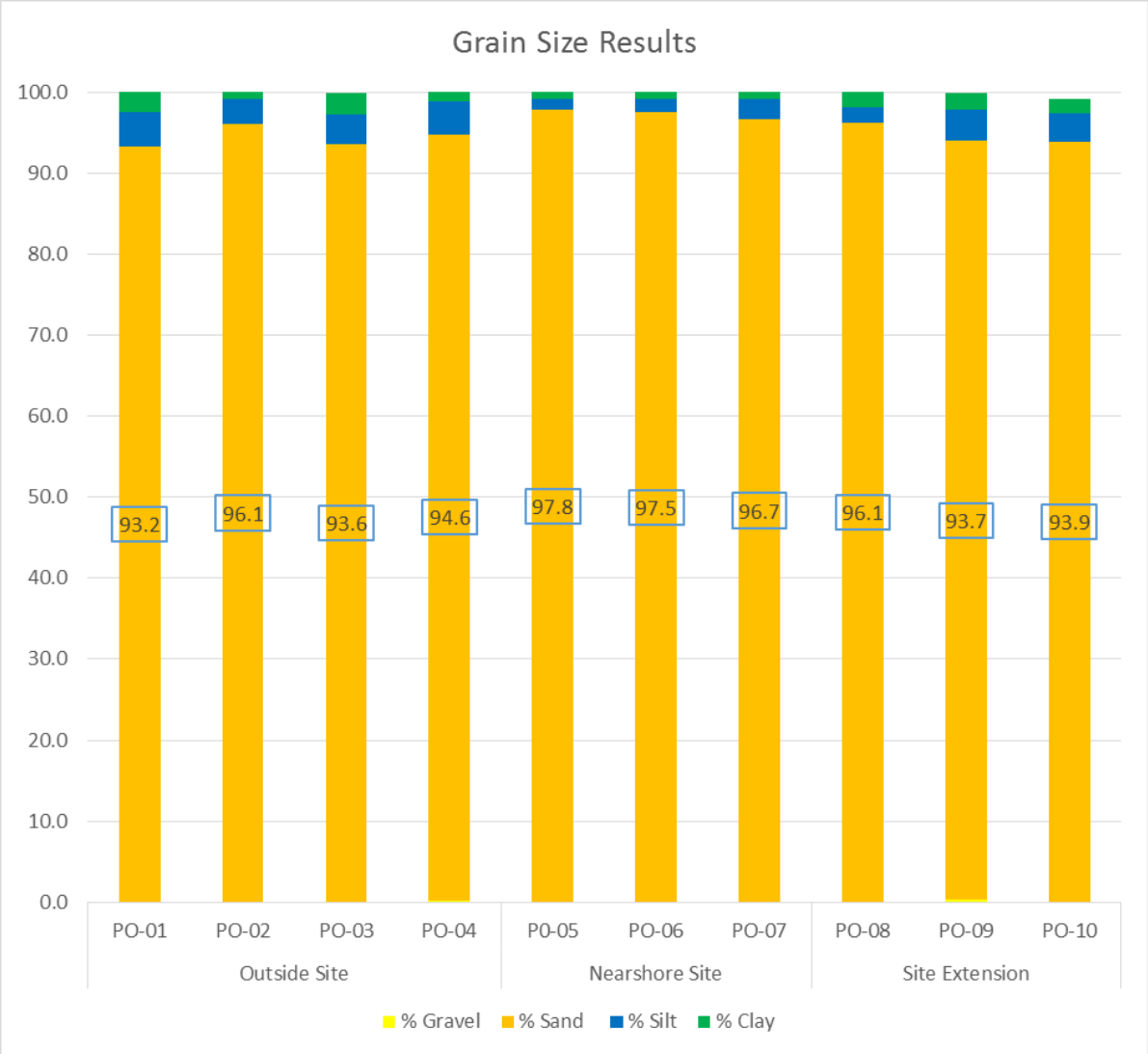



**Figure 3-1. Percent Grain Size Distribution – Port Orford**

**Table 3-1** summarizes additional physical data. All samples were classified as poorly graded sand with silt (SP-SM) or poorly graded sand (SP) and non-plastic. Percent TOC was highest in sample PO-01 and ranged from 0.128% to 0.785% among all samples.

**Table 3-1. Unified Soil Classification System (USCS) Soil Classes, Percent Solids, Specific Gravity, and TOC – Port Orford**

| Sample ID | USCS Soil Class[1] | Total Solids (%) | Specific Gravity | TOC (%) |
|---|---|---|---|---|
| PO-01 | SP-SM | 68.5 | 2.67 | 0.785 |
| PO-02 | SP | 77.7 | 2.70 | 0.191 |
| PO-03 | SP-SM | 72.4 | 2.71 | 0.318 |
| PO-04 | SP-SM | 72.2 | 2.73 | 0.292 |
| PO-05 | SP | 79.3 | 2.70 | 0.204 |
| PO-06 | SP | 76.9 | 2.72 | 0.128 |
| PO-07 | SP | 75.3 | 2.71 | 0.152 |
| PO-08 | SP | 73.7 | 2.71 | 0.315 |
| PO-09 | SP-SM | 72.5 | 2.71 | 0.252 |
| PO-10 | SP-SM | 72.9 | 2.72 | 0.261 |

[1] USCS classes defined: SP-SM = poorly graded sand with silt; SP = poorly-graded sand.

See **Appendix C and E** for complete physical analysis results.

## 3.2 Umpqua River Results

Physical, conventionals, and chemistry samples were collected and analyzed from eight stations within the Umpqua River federal navigation channel and boat basins as summarized in **Table 2-2** and shown in **Maps 2 and 3**.

### 3.2.1 Physical Results

Eight samples were collected for physical grain size analysis. Complete results for physical analysis are presented in the laboratory reports provided in **Appendix C**. Percent grain size distribution is presented in **Figure 3-2**. All of the samples within the Umpqua River federal navigation channel consisted of predominately sand ranging from 91.0% to 97.2%. The two samples collected from the boat basins in Winchester consisted primarily of fines (silt/clay) ranging from 82.4% to 93.1%.

**Table 3-2** summarizes additional physical data. All samples within the Umpqua River federal navigation channel were classified as poorly graded sand with silt (SP-SM) or poorly graded sand (SP) and non-plastic. The samples collected from boat basins east and west were classified as sandy elastic silt (MH).

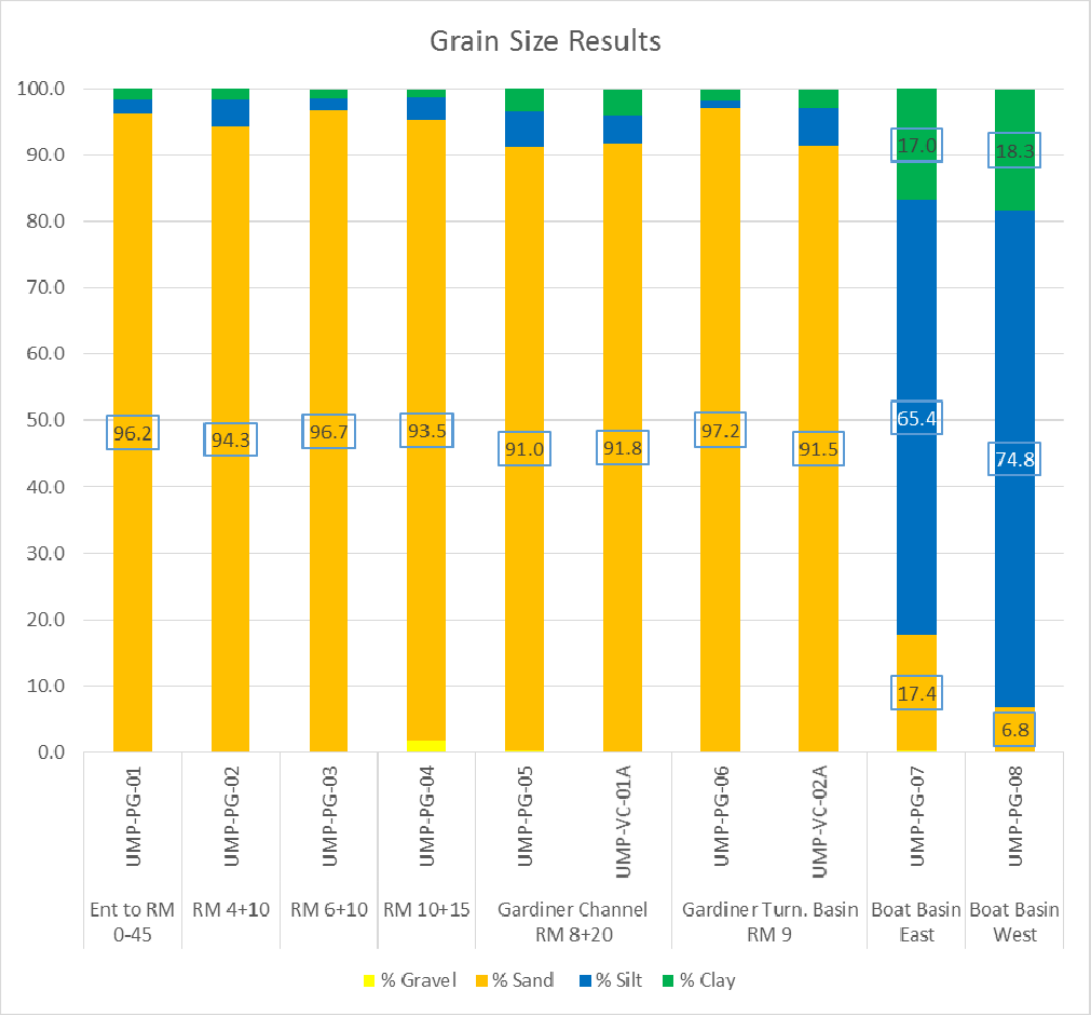



**Figure 3-2. Percent Grain Size Distribution – Umpqua River and Boat Basins**

**Table 3-2. USCS Soil Classes, Void Ratio, Dry Density, and Moisture Content – Umpqua River and Boat Basins**

| Sample ID | USCS Soil Class[1] | Void Ratio | Dry Density (pcf) | Moisture Content (%) |
|---|---|---|---|---|
| UMP-PG-01 | SP-SM | 0.78 | 93.7 | 23.7 |
| UMP-PG-02 | SP-SM | 1.00 | 85.0 | 35.4 |
| UMP-PG-03 | SP-SM | 0.83 | 92.6 | 26.7 |
| UMP-PG-04 | SP | 1.14 | 78.2 | 41.6 |
| UMP-PG-05 | SP-SM | 1.07 | 82.4 | 35.2 |
| UMP-VC-01A | SP | 1.22 | 76.5 | 42.6 |
| UMP-PG-06 | SP | 1.15 | 79.3 | 40.9 |
| UMP-VC-02A | SP-SM | 1.49 | 68.2 | 54.2 |
| UMP-PG-07 | MH | 3.71 | 35.4 | 138.1 |
| UMP-PG-08 | MH | 3.65 | 35.9 | 135.3 |

[1] USCS classes defined: SP-SM = poorly graded sand with silt; SP = poorly-graded sand; MH = Sandy elastic silt.
See **Appendix C** for complete results of physical analyses.

### 3.2.2 Conventionals Results

TOC analyses were run on all eight samples collected from the Umpqua River federal navigation channel and the two boat basin samples. The additional conventional analyses (total sulfides and ammonia) were run on UMP-VC-01A and UMP-VC-02A. The two samples from Boat Basin East and Boat Basin West were composited into one sample (UMP-COMP-1) for additional conventionals analysis. **Table 3-3** summarizes additional conventionals data. Percent TOC from samples collected within the Umpqua River federal navigation channel ranged from 0.105% to 0.526%. Percent TOC from samples collected within the boat basins ranged from 3.13% to 3.27%.

**Table 3-3. Conventionals Results – Umpqua River and Boat Basins**

| Sample ID | Total Solids (%) | TOC (%) | Total Sulfides (mg/kg) | Ammonia |
|---|---|---|---|---|
| UMP-PG-01 | 77.8 | 0.047 | -- | -- |
| UMP-PG-02 | 72.9 | 0.105 | -- | -- |
| UMP-PG-03 | 72.4 | 0.078 | -- | -- |
| UMP-PG-04 | 68.1 | 0.300 | -- | -- |
| UMP-PG-05 | 66.1 | 0.564 | -- | -- |
| UMP-VC-01A | 69.5 | 0.317 | <0.8 | 1.53 |
| UMP-PG-06 | 69.8 | 0.134 | -- | -- |
| UMP-VC-02A | 66.6 | 0.526 | 36 | 2.65 |
| UMP-PG-07 | 42.4 | 3.13 | -- | -- |
| UMP-PG-08 | 40.4 | 3.27 | -- | -- |
| UMP-COMP-1 | 37.8 | -- | 1020 | 21.1 |

-- Analyses not performed
"Not detected (U-qualified)" results reported as "<Method Detection Limit"
See **Appendix E** for complete conventionals analysis results.

### 3.2.3 Chemistry Results

Chemical analyses of chemical of concern were run on UMP-VC-01A and UMP-VC-02A. The two samples from Boat Basin East and Boat Basin West were composited into one sample (UMP-COMP-1) for additional chemical analysis. Chemistry results are presented in **Tables 3-4**

**through 3-12**. No sample results exceeded benthic toxicity screening levels as presented in the SEF Table 6-2 for any analytes tested.

**Table 3-4. Sediment Metals Results – Umpqua River and Boat Basins**

| METALS (mg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Antimony | 0.062 | 0.065 | 0.096 | 150 |
| Arsenic | 3.66 | 3.83 | 6.59 | 57 |
| Cadmium | 0.045 | 0.046 | 0.390 | 5.1 |
| Chromium | 22.8 | 25.0 | 49.6 | 260 |
| Copper | 8.58 | 9.32 | 29.5 | 390 |
| Lead | 3.26 | 3.63 | 6.78 | 450 |
| Mercury | 0.018 | 0.016 | 0.054 | 0.41 |
| Nickel | 22.5 | 22.7 | 49.2 | -- |
| Silver | 0.012 | 0.014 | 0.059 | 6.1 |
| Zinc | 37.4 | 42.2 | 65.2 | 410 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

See **Appendix E** for complete results.

**Table 3-5. Sediment PAH Results – Umpqua River and Boat Basins**

| PAHs (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| **Total LMW PAHs** | 21.6 | 21.6 | 143 | 5200 |
| Naphthalene | <2.9 | <2.9 | <19 | 2100 |
| Acenaphthylene | <2.6 | <2.6 | <17 | 560 |
| Acenaphthene | <3.2 | <3.2 | <21 | 500 |
| Fluorene | <3.3 | <3.3 | <22 | 540 |
| Phenanthrene | <3.6 | <3.6 | <24 | 1500 |
| Anthracene | <3.2 | <3.2 | <21 | 960 |
| 2-Methylnaphthalene | <2.8 | <2.8 | <19 | 670 |
| **Total HMW PAHs** | 36 | 36 | 254 | 12000 |
| Fluoranthene | <3.7 | <3.7 | <38 | 1700 |
| Pyrene | <3.7 | <3.7 | <25 | 2600 |
| Benz(a)anthracene | <3.6 | <3.6 | <24 | 1300 |
| Chrysene | <4.1 | <4.1 | <27 | 1400 |
| Benzo(b)fluoranthene | <3.4 | <3.4 | <23 | 3200 |
| Benzo(k)fluoranthene | <4.0 | <4.0 | <27 | 3200 |
| Benzo(a)pyrene | <3.6 | <3.6 | <24 | 1600 |
| Indeno(1,2,3-c,d)pyrene | <3.2 | <3.2 | <21 | 600 |
| Dibenz(a,h)anthracene | <3.0 | <3.0 | <20 | 230 |
| Benzo(g,h,i)perylene | <3.7 | <3.7 | <25 | 670 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-6. Sediment Chlorinated Hydrocarbon Results – Umpqua River and Boat Basins**

| Chlorinated Hydrocarbons (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| 1,4-Dichlorobenzene | <2.5 | <2.5 | <17 | 110 |
| 1,2-Dichlorobenzene | <2.4 | <2.4 | <16 | 35 |
| 1,2,4-Trichlorobenzene | <2.6 | <2.6 | <17 | 31 |
| Hexachlorobenzene | <3.3 | <3.3 | <22 | 22 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-7. Sediment Phthalates Results – Umpqua River and Boat Basins**

| Phthalates (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Dimethylphthalate | <4.0 | <4.0 | <27 | 71 |
| Diethylphthalate | <3.7 | <3.7 | <25 | 200 |
| Di-n-butyl-phthalate | <4.8 | <4.8 | <32 | 1400 |
| Butyl benzyl phthalate | <3.7 | <3.7 | <25 | 63 |
| Bis(2-ethylexyl)phthalate | <8.9 | <8.9 | <58 | 1300 |
| Di-n-octyl-phthalate | <3.2 | <3.2 | <21 | 6200 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-8. Sediment Phenols Results – Umpqua River and Boat Basins**

| Phenols (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Phenol | 25 | 3.8 | 28 | 420 |
| 2-Methylphenol | <4.1 | <4.1 | <27 | 63 |
| 4-Methylphenol | 39 | <4.5 | 59 | 670 |
| 2,4-Dimethylphenol | <6.3 | <6.3 | <41 | 29 |
| Pentachlorophenol | <5.3 | <5.3 | <35 | 400 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-9. Sediment Miscellaneous Extractable Compounds Results – Umpqua River and Boat Basins**

| Misc. Extr. (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Benzyl alcohol | <4.9 | <4.9 | 32 | 57 |
| Benzoic acid | <96 | <96 | <630 | 650 |
| Dibenzofuran | <3.4 | <3.4 | <23 | 540 |
| Hexachlorobutadiene | <3.0 | <3.0 | <20 | 11 |
| N-nitrosopenylamine | <3.2 | <3.2 | <21 | 28 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-10. Sediment Pesticide Results – Umpqua River and Boat Basins**

| Pesticides (µg/kg) | | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|---|
| DDDs | 2,4'-DDD | <0.11 | <0.11 | <0.15 | 16 |
| | 2,4'-DDD (re-run) | <0.11 | <0.11 | <0.15 | |
| | 4,4'-DDD | <0.10 | <0.10 | <0.13 | |
| DDEs | 2,4'-DDE | <0.11 | <0.11 | <0.24 | 9 |
| | 2,4'-DDE (re-run) | <0.11 | <0.11 | <0.15 | |
| | 4,4'-DDE | <0.085 | <0.085 | <0.12 | |
| DDTs | 2,4'-DDT | <0.14 | <0.14 | <0.19 | 12 |
| | 2,4'-DDT (re-run) | <0.14 | <0.14 | <0.19 | |
| | 4,4'-DDT | <0.078 | <0.078 | <0.11 | |
| Aldrin | | <0.056 | <0.056 | <0.073 | 9.5 |
| Total Chlordane | alpha-Chlordane | <0.063 | <0.063 | <0.082 | 2.8 |
| | cis-Nonachlor | <0.49 | <0.49 | <0.64 | |
| | gamma-Chlordane | <0.072 | <0.072 | <0.094 | |
| | Oxychlordane | <0.68 | <0.68 | <0.89 | |
| | trans-Nonachlor | <0.53 | <0.53 | <0.69 | |
| Heptachlor | | <0.055 | <0.055 | <0.072 | 1.5 |
| Dieldrin | | <0.083 | <0.083 | <0.11 | 1.9 |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

Note: 2,4'-DDD, 2,4-DDE, and 2,4-DDT were re-run due to a spiking error, see Section 4.4.1.2.

See **Appendix E** for complete results.

**Table 3-11. Sediment Aroclor Results – Umpqua River and Boat Basins**

| Aroclors (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| **Total Aroclors** | | | | 130 |
| Aroclor 1016 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1221 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1232 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1242 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1248 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1254 | <2.1 | <2.1 | <2.8 | NA |
| Aroclor 1260 | <2.1 | <2.1 | <2.8 | NA |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

**Table 3-12. Sediment Total Petroleum Hydrocarbons Results – Umpqua River and Boat Basins**

| TPH (mg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Diesel Range Organics | 7.1 | 8.5 | 22 | NA |
| Residual Range Organics | 17 | 19 | 110 | NA |

[1] Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

See **Appendix E** for complete results.

**Table 3-13. Sediment Tributyltin Results – Umpqua River and Boat Basins**

| TBT (µg/kg) | UMP-VC-01A | UMP-VC-02A | UMP-COMP-01 | SL1[1] |
|---|---|---|---|---|
| Tributyltin | <0.63 | <0.66 | <1.2 | 73 |

[1] = Screening Level 1 – corresponds to a concentration below which adverse effects to benthic communities would not be expected. *Source: Sediment Evaluation Framework (2016), Table 6-2.*

"Not detected (U-qualified)" results reported as "<Method Detection Limit"

See **Appendix E** for complete results.

# 4 QUALITY ASSURANCE/QUALITY CONTROL

## 4.1 Deviations from Sampling Plan

Sampling and analysis conformed to methods outlined in the SAP, SEF, and PWS, with the following exceptions.

Tributyltin porewater was not analyzed on the sediment samples collected from stations UMP-VC-01 and UMP-VC02, as stated in the PWS. USACE personnel informed the team that this analysis was not necessary.

Due to poor recoveries during vibracoring at stations UMP-VC-01 and UMP-VC-02, USACE advised the team to switch to the Ponar grab sampler to collect the additional volume needed to run the analysis for the A layer surface samples.

No Z-layer sample was collected. DQCRs and completed field logs for each day of sampling are provided in **Appendix B**.

## 4.2 Sample Receipt

### 4.2.1 MTC

Sediment samples were received in good condition and consistent with the chain-of-custody form. Final chains-of-custody are provided with the lab report in **Appendix C**.

### 4.2.2 ALS Environmental

Eleven sediment samples were received for analysis at ALS Environmental on August 26, 2016. The samples were received in good condition and consistent with the accompanying chain-of-custody form. The samples were stored at 4ºC upon receipt at the laboratory. Final chains of custody and sample receipt forms are provided with the lab report in **Appendix E**.

## 4.3 Physical Analysis

All physical analyses were performed by MTC, and the results met the quality control criteria specified in the SAP and SEF. See Case Narrative provided in the laboratory data report for more details (**Appendix C**).

## 4.4 Sediment Chemistry

All analyses were performed consistent with the QA program at ALS Environmental. The lab reports contain analytical results for samples designated for Tier IV validation deliverables, including summary forms and all associated raw data for each analysis. When appropriate to the method, method blank results have been reported with each analytical test. See the Case Narrative provided in the laboratory data report for more details (**Appendix E).** Also, see the CQAR for results of ANAMAR's QA/QC of the data report (**Appendix D).**

### 4.4.1 Quality Control Deviations

#### 4.4.1.1 Conventionals

**Total Organic Carbon**

No QC issues were identified with the samples for this project.

**Ammonia**

No limits provided for QC. All QC met the laboratory QC limits. The lab MRLs exceeded the sample quantitation limits, but all samples were detected at levels greater than the MRL.

**Sulfide**

No limits provided for QC. All QC met the laboratory QC limits. Batch QC was provided for the laboratory duplicate instead of a project sample. The lab MRLs exceeded the sample quantitation limits, but sample UMP-VC-02A and UMP-COMP-01 were detected at levels greater than the MRL. Sample UMP-VC-01A was reported as a non-detect below the MDL. The MDL for this sample was less than the sample quantitation limit.

#### 4.4.1.2 Contaminants of Concern

**Trace Metals**

The matrix spike for antimony was below the CQAR acceptance limits but within the limits for the post digestion spike. This is common for antimony due to the digestion procedure for preparation. All other metals had spikes ranging from 88% to 101%, indicating no matrix interferences in the samples for metals.

**Pesticides**

Due to a spiking error at the lab, the initial analysis of the samples did not include a spike for DDT compounds. The lab re-analyzed the samples with the spike past their initial holding times. Both sets of data are reported to include the DDT compounds. All spikes were within control except the RPD (precision) for 4,4' DDD at 64%.

Several continuing calibration standards were outside the acceptance limits. Since the method uses dual columns, the results were reported from the column with acceptable results, and there is no impact on the results.

**PCB Aroclors**

The MRLs for Aroclor 1221 exceeded the sample quantitation limit for all samples, and the MRLs for all Aroclors exceeded the sample quantitation limit in UMP-COMP-01. The MDLs were below the sample quantitation limit for all Aroclors in all samples.

**PAHs and SVOAs**

The matrix spike had several compounds below 50% recovery. This indicates a likely matrix interference in the samples.

The MRLs for phenol, benzoic acid, and 2,4-dimethylphenol exceeded the sample quantitation limit for all samples, and the MRLs for all SVOA compounds exceeded the sample quantitation limit in UMP-COMP-01. The MDLs for phenol, benzoic acid, and 2,4-dimethylphenol were below the sample quantitation limit for samples UMP-VC-01A and -02A. Although most of the MDLs exceeded the sample quantitation limits for UMP-COMP-01, they were well below the corresponding marine screening levels, and the overall impact based on the screening level 1 should be minimal.

The elevated MDLs and MRLs in UMP-COMP-01 were due to two factors:

- A matrix interference in the sample for SVOA compounds requiring a dilution factor of 5 in order to quantify the results
- Very low solids content of 37.8%.

These two factors combined to increase the MDL and MRL for each analyte by a factor of approximately 10 above a typical sediment sample without any matrix interference and at 75% solids.

**Tributyltin**

No QC issues were identified with the samples for this analytes.

**DRO and RRO**

No limits are provided for QC. All QC met the laboratory QC limits. The lab MRLs exceeded the sample quantitation limits, but all samples were detected at levels greater than the MDL.

# 5 REFERENCES

Northwest Regional Sediment Evaluation Team (RSET). 2016. *Sediment Evaluation Framework for the Pacific Northwest.* Prepared by the RSET Agencies. July 2016. 160 pp plus appendices.