PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

825 NE Multnomah, 1500 LCT
Portland, OR 97232
phone (503) 813-5036

May 18, 2020

Via E-Mail

Hunter Young
Superfund and Emergency Management Division
U.S. Environmental Protection Agency
Oregon Operations Office
805 SW Broadway Suite 500
Portland OR 97205-3331
Young.Hunter@epa.gov

Re: River Mile 11E Project Area, Portland Harbor Superfund Site
Transmittal of the Final Phase I Remedial Design
Sediment Sampling and Analysis Plan - May 2020

Dear Mr. Young:

The River Mile 11E Group is pleased to transmit the final version of the Phase I Remedial Design (RD) Sediment Sampling and Analysis (SAP) for the River Mile 11E (RM11E) Project Area for your approval. This document addresses the April 22, 2020 comments that the U.S. Environmental Protection Agency (EPA) provided to the RM11E Group on the March 31, 2020 version of the SAP. On May 8, 2020, the RM11E Group provided EPA with a formal response to the agency's April 22, 2020 comments; EPA approved the RM11E's response to comments on May 11, 2020. The RM11E Group is also transmitting a redline of the March 31, 2020 version of the SAP and supporting documents to assist you in your review of the document.

The SAP was prepared by GSI Water Solutions, Inc. and Dalton, Olmsted & Fuglevand on behalf of Cargill, Inc.; ViacomCBS Inc.; City of Portland; DIL Trust; Glacier Northwest, Inc.; and PacifiCorp. The report was prepared under the Administrative Settlement Agreement and Order on Consent (ASAOC) for Supplemental Remedial Investigation/ Feasibility Study (RI/FS) Work and Remedial Design, U.S. Environmental Protection Agency (EPA) Region 10, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. 10-2013-0087, Amendment No. 1.

In accordance with Section 16 of the ASAOC, we have enclosed a list of the names and qualifications of all subcontractors that have been retained to perform work as part of the sediment SAP and the geotechnical SAP.

The RM11E Group appreciates your assistance in moving these documents through the review and approval cycle. Please do not hesitate to contact me if you have any questions.

Sincerely yours,

Jacqueline Thiell Wetzsteon
RM11E Project Coordinator

Enclosures

ec: River Mile 11 E Respondents
AOC Notice Recipients (updated by EPA on 4/28/20)
Paul Fuglevand

Below please find the qualifications for the subcontractors proposed for use by the RM11E Group to complete the Phase 1 sediment and geotechnical sampling identified in the respective sampling and analysis plans prepared by GSI/DOF and GRI. The field sampling scope of work is currently scheduled to begin May 26th, 2020 and extend through September 2020. Please let us know if you have any concerns regarding the use of these subcontractors.

Phase 1 Sediment Sampling

Marine Sampling Systems, LLC (MSS): MSS is a small business located in Washington State providing vessels and sampling support for marine and freshwater projects throughout the western U.S. and Canada. MSS was originally established in 1989, and in 2018 it became a limited liability partnership. MSS has conducted numerous sediment sampling projects throughout the Pacific Northwest, California, Hawaii, Idaho, Utah, Wyoming, and British Columbia. MSS has collected over 10,000 cores and 30,000 grab samples and is, therefore, highly experienced in sediment characterization. Their services will include providing sampling vessels and associated staff for the collection of Sediment Profile Imaging (SPI), surface sediment grabs, and subsurface sediment cores.

Cascade Drilling: Cascade Drilling provides a full range of environmental and geotechnical drilling services. Cascade Drilling was founded in 1991 as a highly regarded Northwestern U.S. regional drilling company operating across three states, and they developed a strong reputation for safety, service, and reliability, with a particular emphasis on traditional drilling technologies. In 2013, the company made a significant investment in sonic drilling technology and expanded its geographic reach across the United States. Their fleet includes track- and truck-mounted equipment and limited access rigs for tight spaces, low overhead conditions, and over-water work. Cascade Drilling will provide a sonic drill rig and core sampling equipment and crew to support over-water drilling activities.

APEX Laboratories (Tigard, OR): Apex Laboratories is a full-service, commercial environmental laboratory that has been working on Portland Harbor projects since 2008. They are located in Tigard, Oregon, and are NELAP/ORELAP certified. Their services will include a variety of chemical analyses. APEX will also coordinate all subcontracted laboratories as described further in the QAPP.

ALS Laboratories (Kelso, WA): ALS provides a full range of environmental testing services and is one of the largest environmental laboratory networks in the world. Because the Kelso facility specializes in non-routine analyses requiring a high degree of technical expertise, the laboratory has taken part in a number of method development studies for the U.S. EPA and various state and industrial agencies. The Kelso laboratory has also held a number of direct EPA contracts under the U.S. EPA Contract Laboratory Program (CLP). They specialize in marine and freshwater sediments, waters, and tissues, and they are NELAP/ORELAP certified. The Kelso laboratory will analyze the bulk sediment samples for design as well as implementation-specific properties.

QA/QC Solutions, LLC: QA/QC Solutions, LLC, specializes in completing data quality assessment (DQA) and usability evaluations; interpreting chemical fingerprinting data; verifying, validating, and evaluating analytical data; and managing the QA/QC aspects of projects. QA/QC Solutions, LLC, is a certified Tier -1 Emerging Small Business (ESB) by the Oregon State Office of Minority, Women, and Emerging Small Business (OMWESB) effective December 16, 2010 (Certification Number 7475). QA/QC Solutions will conduct a third-party QA review (data validation) of the analytical data; they will add qualifiers, as

needed, to the electronic data deliverables submitted by the primary contract laboratory and provide the validated laboratory results to GSI for incorporation into the project database.

TerraHydr, Inc.: Terra Hydr, Inc., is a general contractor specializing in a wide variety of civil and environmental construction services. They are based in the Portland metropolitan area and were established in 1994. TerraHydr will provide services related to Vibracore sampling support and IDW management.

Willamette Cultural Resources Associates, Ltd.: Willamette Cultural Resources Associates, Ltd., (Willamette CRA) is a full-service cultural resource management firm with offices in Portland, Oregon, and Seattle, Washington. Willamette CRA's research and investigative services are designed to meet federal, state, and local government historic preservation compliance requirements. They have experience with EPA CERCLA, Oregon DEQ programs, and Hazardous Waste Operations and Emergency Response, and they have previously worked with the Port of Portland, Metro, and Native American tribes throughout the Northwest. Willamette CRA will provide cultural resource training to field staff before sediment sampling begins and will provide monitoring services, as necessary, during sediment sample collection.

Phase 1 Geotechnical Investigation

Bergerson Construction, Inc.: Bergerson Construction has been providing marine construction services throughout Oregon and Washington since 1968. Their marine projects include pile driving, seawalls, bulkheads, cofferdams, bridge and pier structures, floating structures, dredging, shoreline protection, marine outfalls and intakes, water remediation and demolition. Bergerson Construction will provide a barge, vibratory and impact pile driving equipment, sheet piling and complete a test pile program to evaluate the feasibility of installing temporary shoring along the riverbank.

Western States Soil Conservation, Inc. (Western States): Western States is headquartered in Hubbard, Oregon. They are a specialty firm that provides geotechnical and environmental drilling as well as vacuum excavator services. Western States has previous experience at the project site having completed geotechnical soil borings for the RM11E Implementability Study Report and previously completed geotechnical borings in the Willamette River in support of PacifiCorp cable relocation project. Their services will include geotechnical drilling and vacuum excavator services.

Oregon Geotechnical Explorations, Inc.: Oregon Geotechnical Explorations, Inc., is based out of Keizer, Oregon. This company specializes in geotechnical and environmental drilling explorations involving cone penetration testing (CPT) and direct push technology. This company's projects include subsurface explorations at the Port of Kalama, Port of Camas, Port of Vancouver, Portland International Airport, and the University of Portland. Their services will include CPT testing.

Mark Marine Service, Inc. (Mark Marine): Mark Marine is based out of Washougal, Washington and has provided marine services in the Portland area since 1980. They provide are a multi-faceted, marine-based construction firm with experience with pile driving, bucket dredging and water crane work. Their services will include providing a barge with a moon pool and anchoring spuds in support of Western States Soil Conservation, Inc., as well as support watercraft for ferrying equipment and personal to and from the barge.

Apex Laboratories: Apex Laboratories is a full-service, commercial environmental laboratory that has been working on Portland Harbor projects since 2008. They have successfully analyzed large numbers of sediment and water samples at the Gasco site over the past 10 years. They are in Tigard, Oregon, and are NELAP/ORELAP certified. Their services will include a variety of chemical analyses in order to characterize investigative derived waste for disposal.

Private Utility Locating, LLC.: Private Utility Locating, LLC., based out of Portland, OR, has over 25 years of experience in providing private underground utility locating throughout Oregon and SW Washington. Their services will include locating potential conductible utilities near the proposed upland soil boring and CPT probe location.

This page intentionally left blank.

Phase I Remedial Design Sediment Sampling and Analysis Plan

Prepared for

RM11E Group

May 2020

Prepared by

GSI Water Solutions, Inc.
55 SW Yamhill Street, Suite 300
Portland, OR 97204
P: 503.239.8799
info@gsiws.com
www.gsiws.com

DOF DALTON OLMSTED FUGLEVAND

This page intentionally left blank.

Contents

1. Introduction 1
   1.1 Project Area Description 1
   1.2 Remediation Thresholds and Target Material 1
   1.3 Phase I Sampling Purpose and Objectives 2
   1.4 RM11E Remedial Design Process 3
   1.5 Existing Data and Previous Investigations 4
   1.6 Current SMAs 5
   1.7 SAP Preparation and Content 5
   1.8 Project Schedule 6
2. Project Organization 7
   2.1. Program Manager 7
   2.2. Lead Engineer 7
   2.3. Field Investigation Project Director 7
   2.4. Field Investigation Project Manager 8
   2.5. Sampling and Analysis Coordinator 8
   2.6. Field Safety Officer 9
   2.7. Field Support 9
   2.8. Data Validation and Management Support 9
   2.9. Laboratory Services 9
3. Sampling Approach 11
   3.1. SMA Refinement Sampling 11
      3.1.1. SMA Refinement Analyte Selection 12
      3.1.2. Areas 1-4 – Refine Riverward Margin in Main SMA 13
      3.1.3. Area 1 – Refine SMA Footprint at Southern Extent of Project Area 13
      3.1.4. Area 5 – Fill Data Gap in Stan Herman Warehouse Footprint 14
   3.2. Area 6 CSM Verification 14
      3.2.1. Sub-Bottom Profile Survey 14
      3.2.2. Sediment Profile Imaging Survey 14
      3.2.3. Sonic Drilling 15
      3.2.4. Data Reduction and Reporting 15
   3.3. DOC/Dredge Prism Design Sampling 15
      3.3.1. Spatial Considerations and Depth 15

3.3.2. Analyte Selection 16
3.4. Bulk Sediment Sampling for Remedial Action Evaluations 17
4. Field and Sampling Activities 19
4.1. Change Management 19
4.2. Navigation and Station Locating 19
4.2.1. Vertical Positioning 20
4.2.2. Establishing Final Sample Coordinates 20
4.3. Sample Identification and Container Specifications 20
4.3.1. Sample Containers and Handling 21
4.3.2. Field Logbook and Forms 21
4.4. Sub-Bottom Profile Surveying 21
4.5. SPI Surveying 22
4.6. Surface Sediment Sampling 22
4.6.1. Power-Grab Sampling 23
4.6.2. Contingency Plan for Power-Grab Samples 23
4.6.3. Manual-Grab Sampling 23
4.6.4. Sample Collection and Processing 24
4.7. Subsurface Sediment Sampling 24
4.7.1. Vibracore Sampling 24
4.7.2. Vibracore Sample Acquisition Measurement 25
4.7.3. Sonic Drilling and Coring Sampling 27
4.7.4. Contingency Plan for Subsurface Sediment Sampling 27
4.7.5. Sample Collection 28
4.7.6. Sample Processing 28
4.8. Bulk Sediment Sampling 29
4.9. Bulk Water Sample Collection 29
4.10. Sample Custody and Transport 30
4.11. Decontamination Procedures 30
4.12. Investigation-Derived Waste Disposal 30
4.13. Cultural Resource Monitoring 31
5. Laboratory Analysis 32
5.1. Surface Sediment Samples 32
5.1.1. Areas 1 and 4 32
5.1.2. Areas 2 and 3 32

5.1.3. Area 5 32
5.2. Subsurface Sediment Samples 32
5.2.1. Areas 1 through 4 32
5.2.2. Area 6 34
5.3. Bulk Sediment Samples 34
5.4. DRET and Bulk Water Samples 35
5.5. QA/QC Procedures 35
6. Data Management 36
6.1. Field Data Management 36
6.2. Electronic Data Management 36
7. Reporting 37
8. References 38

Tables

Table 3-1 Sampling Locations within Each Sample Area
Table 3-2 Rationale for Proposed Sediment Sampling Locations
Table 3-3 Bulk Sediment Sampling IDs
Table 4-1 Proposed Sampling Locations
Table 4-2 Sample Containers, Preservation, and Holding Times
Table 4-3 Subsurface Sediment Sample Methodology, Target Depth, and Anticipated Depth of Contamination
Table 5-1 Surface Sediment Sample Analytes
Table 5-2 Subsurface Sediment Sample Tiered Analytical Program for Areas 1 through 4
Table 5-3 Bulk Sediment Sample Analytes
Table 5-4 DRET and Bulk Water Sample Analytes
Table 5-5 Field Quality Control

Figures

Figure 1-1 RM11E Project Area
Figure 1-2 RM11E Historical Sediment and Soil Sample Locations
Figure 2-1 Project Organizational Chart
Figure 3-1 Proposed Surface and Subsurface Sediment Sampling Stations
Figure 3-2 Proposed Surface Sediment Sampling Stations
Figure 3-3 Proposed Sub-Bottom Profile Transects
Figure 3-4 Proposed SPI Survey Locations
Figure 3-5 Proposed Subsurface Sediment Sampling Stations
Figure 3-6 Proposed Bulk Sediment Sampling Stations
Figure 4-1 Historical Coring Locations
Figure 4-2 Coring with Incremental Acquisition Data

Figure 5-1 Example of Tiered Analytical Approach

Attachments

Attachment 1 RM11E - Project Area and Sediment Management Areas Technical Memorandum
Attachment 2 RM11E DDx Evaluation Technical Memorandum
Attachment 3 Field Forms
Attachment 4 Cascade Drilling Memorandum, Using V-Sampler for 11 Mile Overwater Investigation on the Willamette River in Portland, Oregon
Attachment 5 Plan and Procedures for the Inadvertent Discovery of Human Skeletal Remains and Cultural Resources (Inadvertent Discovery Plan)

Appendices

Appendix A GSI Health and Safety Plan
Appendix B Quality Assurance Project Plan
Appendix C Data Quality Management Plan

This page intentionally left blank.

Abbreviations and Acronyms

µg/kg	microgram per kilogram
AOC	Administrative Settlement Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BEHP	bis(2-ethylhexyl)phthalate
BODR	Draft Basis of Design Report River Mile 11 East
Cargill	Cargill, Inc.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
City	City of Portland
cm	centimeter
CSM	conceptual site model
COC	contaminant of concern
CUL	cleanup level
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDx	The sum of 2,4' and 4,4' - DDD, DDE, DDT
DM	Data Manager
DOC	depth of contamination
DOF	Dalton, Olmsted & Fuglevand, Inc.
DRET	Dredging Elutriate Test
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	feasibility study
FSO	Field Safety Officer
ft	foot or feet
Glacier	Glacier Northwest, Inc.
GNSS	Global Navigation Satellite System
GPS	global positioning system
GSI	GSI Water Solutions, Inc.
HDPE	high-density polyethylene
HSP	Health and Safety Plan
HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
IDW	investigation-derived waste

L	liter
m	meter
MSS	Marine Sampling Systems, LLC
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
OHWL	ordinary high water line
ORS	Oregon Revised Statute
PCB	polychlorinated biphenyl
PCDD/Fs	polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PeCDD	1,2,3,7,8-pentachlorodibenzo-p-dioxin
PeCDF	2,3,4,7,8-pentachlorodibenzofuran
PM	Field Investigation Project Manager
Portland Harbor	Portland Harbor Superfund Site
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QA/QC Solutions	QA/QC Solutions, LLC
QC	quality control
RA	recontamination assessment
RAL	remedial action level
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDGC	Remedial Design Guidelines and Considerations
RDWP	Remedial Design Work Plan
RG	registered geologist
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RM	river mile
RM11E	River Mile 11 East
RM11E Group	Cargill, Inc.; CBS Corporation; City of Portland; DIL Trust; Glacier Northwest, Inc.; and PacifiCorp
ROD	record of decision
RT	remediation threshold
SAC	Sampling and Analysis Coordinator
SAP	sampling and analysis plan
Site	RM11E Project Area
SMA	sediment management area
SOW	statement of work

SPI	Sediment Profile Imaging
TBD	to be determined
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USGS	U.S. Geological Survey
Willamette CRA	Willamette Cultural Resources Associates, LTD
Work Plan	Final Supplemental Remedial Investigation/Feasibility Study Work Plan

This page intentionally left blank.

1. Introduction

This Phase I Remedial Design (RD) Sediment Sampling and Analysis Plan (SAP) was prepared by GSI Water Solutions, Inc. (GSI), on behalf of Cargill, Inc. (Cargill); CBS Corporation; City of Portland (City); DIL Trust; Glacier Northwest, Inc. (Glacier); and PacifiCorp, collectively referred to as the River Mile 11 East (RM11E) Group. This work is conducted under the Administrative Settlement Agreement and Order on Consent (AOC) for Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work and Remedial Design, U.S. Environmental Protection Agency (EPA) Region 10, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. 10-2013-0087, Amendment No. 1.

This SAP is a component of the Remedial Design Work Plan (RDWP), which is a requirement set forth in Section 3.3 of the RD Statement of Work (SOW) for the RM11E Project Area, dated December 2017. This SAP has been completed and submitted to EPA prior to finalizing the RDWP to accommodate an accelerated schedule to begin collection of design-level data in the first half of 2020. Consequently, this SAP includes information on project objectives, regulatory framework, and site conditions that would typically be included in the RDWP, but are included herein for context and as supporting information.

1.1 Project Area Description

The RM11E Project Area (Site), shown in Figure 1-1, lies between approximately river mile (RM) 10.9 and RM 11.6 along the east bank of the Willamette River. The Site is predominantly in water but also includes the riverbank area from the water line to the top of the bank. The uplands adjacent to the Site are developed with commercial and industrial facilities, roadways and railways, and an electrical substation. The Site comprises active docks associated with current operations at waterfront properties, including Cargill and Glacier.

Other in-water structures include fields of remnant piles from historical warehouses and docks, dolphins, and similar structures placed in the river for navigational, operational, or engineering purposes. Multiple stormwater outfalls and two submarine cable crossings (one owned by PacifiCorp/CenturyLink, crossing downstream of the Broadway Bridge, and one owned by Level 3 Communications, crossing upstream of the Fremont Bridge) are also present at the Site.

1.2 Remediation Thresholds and Target Material

The Basis of Design Report River Mile 11 East (BODR) (DOF and GSI, 2019) introduced two terms for describing sediments under consideration for remedial action:

> **Remediation Thresholds (RT)**. The Portland Harbor Superfund Site (Portland Harbor) Record of Decision (ROD) Table 21 presents remedial action levels (RALs) for the Portland Harbor site and the navigation channel, and principal threat waste (PTW) thresholds (EPA, 2017). At RM11E, remediation thresholds (RTs)[1] are the lower of the

[1] RTs apply to all Focused contaminants of concern (COCs) listed in ROD Table 21. The revised RTs for total polycyclic aromatic hydrocarbons (PAHs) are based on the values in EPA's Explanation of Significant Differences (ESD) (EPA, 2019).

RAL value or PTW concentrations from the ROD Table 21 (BODR Section 2.6). Refer to the BODR, Table 2-5, for RTs.

In the nearshore area, the RT[1] is consistently the Portland Harbor site-wide RAL. In the navigation channel, the RT is the PTW threshold for total polychlorinated biphenyls (PCBs) and 2,3,4,7,8-pentachlorodibenzofuran (PeCDF), and the RT is the navigation channel RAL for total PAHs; total DDx;[2] 1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD); and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Target Material. Sediments that exceed RTs and are thereby under consideration for active remediation by dredging or capping (BODR Section 5.1).

Both terms, RT and Target Material, are used extensively in this SAP.

1.3 Phase I Sampling Purpose and Objectives

The purposes of the work described in this SAP are to (1) collect design-level data to facilitate final identification of remedial technologies and (2) advance an alternatives evaluation, support selection of a Preferred Alternative, and support development of the final RD to meet the cleanup requirements set forth in the ROD (EPA, 2017). It is anticipated that the design-level sampling will be undertaken in two phases (BODR Section 8.1; DOF and GSI, 2019); this SAP describes the first phase of work. This Phase I SAP is designed to meet the following objectives:

- **Refine RM11E SMAs.** The currently defined sediment management area (SMA) footprints for RM11E are shown on Figure 1-1. These SMA footprints are based on historical data, some of which are more than nine years old. Changes in surface sediment concentrations may have occurred due to natural recovery or other processes. As such, RD surface and subsurface sediment sampling will be completed to refine the lateral and vertical extent of relevant Portland Harbor COCs to refine the SMA footprints (discussed further in Section 3.1).
- **Verify Area 6 Conceptual Site Model.** The Area 6 conceptual site model (CSM) will be verified by further evaluating the thickness and lateral distribution of soft sediments overlying the native gravel substrate. A sub-bottom profile survey, Sediment Profile Imaging (SPI), and five 5-ft (target depth) sonic core subsurface sediment locations will be sampled to support the evaluation of potential remedial technologies for this area.
- **Characterize the DOC of the Target Material.** The depth of contamination (DOC) has not been determined in some areas. RD sampling will be conducted to provide refined definition of the DOC of Target Material as needed for the alternatives evaluation and RD.
- **Develop Dredge Prisms for the Alternatives Evaluation and RD.** Samples collected from subsurface cores will be analyzed to provide physical and chemical properties for dredging design, design of dredge water management systems, disposal of dredged material, and the alternatives evaluation. Sampling technologies will be selected to provide the vertical accuracy appropriate for RD. Note that for capping evaluations, data collected from the Phase I cores will be supplemented by existing subsurface COC data, as needed, and

[2] Total DDx is the sum of 2,4' and 4,4' - dichlorodiphenyldichloroethane (DDD), dichlorodiphenyl-dichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT).

additional subsurface sampling of the capping areas established in the final Preferred Alternative Report will be completed, as needed, during a Phase II RD sampling program.

1.4 RM11E Remedial Design Process

As discussed previously, the overall primary purpose of the Phase I RD sampling is to provide information to support the RD process. This process consists of the following four key elements:

Alternatives Evaluation. The majority of the RM11E SMAs are located in open-water areas and have been targeted for dredging. For areas behind, beneath, and around the Glacier and Cargill docks, several separate and distinct remedial approaches have been identified in the BODR. Selection and refinement of remedial technologies requires further evaluation to address significant site-specific considerations including the extent of the DOC across the Site, geotechnical factors, structural factors, facility operation factors, constructability factors, habitat factors, Applicable or Relevant and Appropriate Requirements (ARARs), and work timing and access factors. The alternatives evaluation will rely, in part, on the findings of the Phase I sampling program.

Preferred Alternative and 30% Design. The alternatives evaluation will conclude with the identification of a preferred alternative that will consist of a combination of specific and implementable remedial technologies across the Site. A Preferred Alternative Report will be submitted to EPA. After EPA's approval of the Preferred Alternative Report, the preferred alternative will be used for, and detailed in, the 30% Design, with initial plans and cross sections showing specific areas of dredging, capping (including hybrid capping technologies), in situ treatment, bank stabilization, facility modifications, changes to habitat characteristics, and a 30% Design-level schedule. Additionally, the proposed Phase I surface and subsurface sediment sampling will provide improved mapping of subsurface RT exceedances for the 30% Design.

Phase II Sampling. A second phase of RD sediment characterization will be initiated after the preferred alternative has been established and after 30% Design. The second phase will include refining the expected lateral extent of dredging and capping technology applications and any other identified potential data gaps such as the need for additional sampling in Area 6.

Riverbank soil sampling will be conducted in Phase II. At this point, the specifics of the riverbank stabilization actions are not known because the riverbank design needs to be integrated with the in-water remedy currently under development. The identification of a preferred alternative for the Site will provide direction and a stronger basis for identifying the locations for riverbank soil characterization and the chemicals to be analyzed to meet the design requirements.

Final Design. After EPA's approval of the 30% Design, the intermediate and final design stages (60%, 95%, and 100%) will refine the preferred alternative based on ongoing engineering efforts and review by EPA. Design reports will be prepared and submitted for the remedial action, including construction plans and specifications (at the level of detail appropriate for each design stage). Each subsequent design stage will be a continuation and expansion of the previous stage. These reports will also address EPA's comments regarding the previous stage,

including dredge area and capping area delineations, selection of the sediment processing/transfer facility locations, and establishment of performance standards.

Further details for the RD that address items such as permitting, schedule, and equipment selection will be included in the RDWP.

1.5 Existing Data and Previous Investigations

An extensive amount of sediment characterization work has been completed at the RM11E Site. The Lower Willamette Group conducted multiple field investigations during the RI/FS sampling effort from 2004 through 2008. The City of Portland conducted focused investigations in 2009 and 2010 (GSI, 2010a). The RM11E Group conducted the Supplemental RI/FS in 2013 and 2014. These combined investigations included collection and analysis of surface and subsurface sediment samples, suspended sediments (sediment traps), porewater, riverbank soil and debris, groundwater, and fish tissue. The City's RM11E Focused Sediment Characterization (2009 through 2013) included the collection of sediments from 60 surface and 50 subsurface sampling locations and settleable suspended sediments from 7 in-river sediment traps, between RM 11 and RM 12.1. Previous investigations are described in Section 3.3 and Section 6.2.1 of the Final Supplemental RI/FS Work Plan, River Mile 11 East, Portland, Oregon (GSI and DOF, 2013) and in the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Section 2.7 of the BODR, with associated tables and figures, presents all prior data on Focused COCs for the RM11E Project Area.

The most recent work conducted by the Pre-RD Group in 2018 consisted of collection and analysis of 12 surface sediment samples at the RM11E Site. The Pre-RD Group did not collect any subsurface sediment cores in the RM11E area (AECOM and Geosyntec, 2019).

All historical soil and sediment (surface and subsurface) sample locations, including the locations for the Pre-RD Group investigation, are shown in Figure 1-2. Sample locations are color-coded on the figure by RT exceedance status (i.e., RT exceedance and no RT exceedance).

In 2018, the RM11E Group completed a Recontamination Assessment (RA) Report, which was a thorough evaluation of contaminant migration pathways to evaluate the potential for recontamination of remediated sediment surfaces (GSI and DOF, 2018). Section 3 of the RA Report presents an evaluation of all Portland Harbor COCs identified in surface sediments in the RM11E Project Area to focus the list of chemicals for consideration during design. This work also confirmed that the primary COCs in sediments driving remediation at RM11E are total PCBs and four dioxin/furan congeners.[3] Section 4 of the RA Report presents a Recontamination CSM that includes physical and chemical descriptions of the upland, riverbank, and in-water areas and provides a basis for the sample design presented in this SAP.

The RA Report identifies recommendations to be considered during RD to mitigate recontamination potential from three pathways. These recommendations consist of the following:

[3] The four congeners are 1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF); PeCDD; PeCDF; and TCDD (GSI, 2018).

- Stabilization of potentially erodible riverbank areas adjacent to the in-water SMAs.
- A cap design that controls potential exposure of contaminated riverbank material and sediments that are not removed by excavation or dredging.
- A cap design that accounts for potential contaminant migration from groundwater advection through buried contaminated sediments.

The Supplemental RI/FS and RA Report also served as primary resources for completing the RM11E BODR in October 2019 (DOF and GSI, 2019).

1.6 Current SMAs

The SMAs depicted in the figures attached to this Phase I RD SAP are the SMAs described in Section 2.7.1 of the BODR and shown in the BODR figures. As noted in the BODR, additional data collected during RD will be used to refine SMA boundaries. In an EPA letter dated January 26, 2018, EPA acknowledged that the RM11E Project Area is the appropriate area within which to focus RD. This was in response to a memorandum submitted by the RM11E Group to EPA on October 19, 2017. SMA boundaries were established by GSI in the memorandum using the ROD RALs and most current data set available at that time. Please refer to Attachment 1, the RM11E – Project Area and Sediment Management Areas Technical Memorandum (October 19, 2017) for detailed discussions on mapping techniques and figures. The memorandum further states that additional samples would be collected during RD to further delineate the active cleanup area.

The RM11E Group and other parties have collected extensive sediment data over 12 years, which is reflected in the data density (see Section 1.5 and Figure 1-2). SMAs will continue to be refined with surface and subsurface sediment data to support RD, including the data collected under this Phase I RD SAP. Please also refer to the Final Supplemental RI/FS Work Plan, River Mile 11 East, Portland, Oregon (GSI and DOF, 2013); Supplemental RI/FS Field Sampling and Data Report (GSI, 2014); Recontamination Assessment Report (GSI and DOF, 2018); and BODR (DOF and GSI, 2019) for further details regarding historical sampling and results.

1.7 SAP Preparation and Content

For data comparability and consistency, the methodologies identified in this SAP follow those used in the 2013 RM11E Final Supplemental RI/FS Work Plan and SAPs where possible and appropriate. Changes from the previous SAPs are driven by the different objectives for this design investigation, which necessitates revised sampling approaches for subsurface sediments and a different analytical program to meet those objectives. This SAP includes three appendices, which are also updated from previous work and are critical to this Phase I RD sampling program. These appendices include the following:

- **Appendix A – GSI Health and Safety Plan (HSP)**. The HSP will be followed to ensure the safety of GSI personnel working onsite and compliance with relevant regulations and standards. The HSP covers all known field hazards associated with the tasks necessary to complete this SAP. All other consultants and subcontractors will prepare their own HSPs and will be responsible for their own health and safety.

- **Appendix B – Quality Assurance Project Plan (QAPP)**. The QAPP presents the details regarding analytical procedures and laboratory quality assurance/quality control (QA/QC) requirements.
- **Appendix C – Data Quality Management Plan (DQMP**). The DQMP will ensure the integrity of RM11E project database. The DQMP describes the existing data that are included in the RM11E project database and includes procedures for incorporation of new data.

1.8 Project Schedule

As EPA is aware, the RM11E Group is preparing for major field activities including geotechnical testing and sediment characterization to support RD. The geotechnical work, outlined in the Geotechnical Sampling and Analysis Plan, River Mile 11 East, Portland, Oregon, is currently scheduled to begin in mid-May 2020 (GRI and DOF, 2020). The sediment characterization is scheduled to begin on June 1, 2020. The goal is to begin work on these dates as planned; however, these projects and others may be delayed if current or potential future restrictions or conditions related to the Coronavirus Disease 2019 (COVID-19) remain in effect for an extended period. In the coming months, the RM11E Group will be communicating regularly with EPA regarding the status of any relevant restrictions related to COVID-19 and the possible impacts and delays to the current project schedule.

2. Project Organization

This section summarizes the organizational structure, responsibilities, and resources required to implement this SAP, including field activities, laboratory services, data validation, data management, and reporting. This SAP will be implemented by a team of scientists and engineers from GSI and Dalton, Olmsted & Fuglevand, Inc. (DOF). The work will also require the services of in-water drilling contractors, cultural resource contractors, analytical laboratories, and a data validation specialist. The project organizational structure is shown in Figure 2-1. Key roles and responsibilities of those roles are described below.

2.1. Program Manager

Paul Fuglevand, a licensed Professional Civil Engineer in Oregon with DOF, serves as the overall Program Manager for the RM11E RD. Paul oversees all elements of the RD project and directs staff from DOF and GSI to complete work in accordance with the AOC and applicable planning documents.

2.2. Lead Engineer

Connor Lamb, a licensed Professional Civil Engineer in Oregon with DOF is the lead engineer for the remedial design. In this role, Connor will work closely with the Program Manager and Field Investigation Project Manager (described in Section 2) to ensure that the project objectives described in Section 1.3 are achieved.

2.3. Field Investigation Project Director

Dave Livesay, a Registered Geologist in Oregon with GSI, is the Field Investigation Project Director (PD) for the RM11E field sampling efforts. In the PD role, Dave will provide technical input to the field investigation team and will participate in decisions that are critical to the successful implementation of the SAP. Dave will work closely with the Program Manager and Field Investigation Project Manager to ensure that the project objectives described in Section 1.3 are achieved.

Specific responsibilities include the following:

- Oversee the planning and implementation of all field sampling efforts in accordance with this SAP.
- Assist with the project team to help address any problems or technical concerns encountered in the field and resolve safety concerns identified by the Field Safety Officer.
- Communicate with the RM11E Group regarding the schedule, performance, and any anticipated deviations from, sampling and analysis activities.
- Communicate with EPA regarding the schedule, performance, and any deviations from the SAP.

2.4. Field Investigation Project Manager

Alison Clements, an environmental scientist with GSI, is the Field Investigation Project Manager (PM) for this Phase I RD investigation. She will report directly to the PD and will coordinate closely with DOF, project staff members, and sampling subcontractors as required. The PM is responsible to do the following:

- Direct the planning and implementation of all field sampling efforts, including arranging for necessary sampling contractors, equipment, and overseeing the daily sampling operations (described in Section 4).
- Coordinate with the owners of waterfront properties with active working docks, marine operations, and vessel traffic to ensure that, to the extent possible, the consultant team's access to these properties will not interfere with the normal activities conducted at these properties and will accommodate periodic operational and security limitations resulting from these operational activities.
- Oversee all aspects of the sampling to ensure that the appropriate procedures and methods are used in accordance with this SAP.
- Coordinate closely with the PD, Sampling and Analysis Coordinator (SAC) discussed below, and field staff members to address any field problems, deviations from this SAP, or emergencies that may arise.
- Communicate with EPA oversight personnel and notify EPA immediately regarding deviations from the SAP.
- Track the schedule and performance of the sampling and analysis activities according to this SAP in direct coordination with the PD.
- Assist with investigation-derived waste (IDW) management and ensure that it is removed in a timely manner from properties owned and/or operated by RM11E Group members.

2.5. Sampling and Analysis Coordinator

Benjamin Johnson, a Registered Geologist in Oregon with GSI, is the Sampling and Analysis Coordinator (SAC). In this role, he will coordinate with sampling contractors, laboratories, and field staff. The SAC will work closely with the PM and lead engineer to ensure data are collected in accordance with the SAP. The SAC is responsible to do the following:

- Coordinate with the analytical laboratories to obtain appropriate sampling containers, facilitate sample deliveries and chain of custody, and to ensure the analytical work is conducted consistent with the requirements set forth in the QAPP.
- Serve as the Field Quality Assurance (QA) Manager to ensure that all appropriate field procedures and methods are followed.
- Maintain copies of field documentation and laboratory chain-of-custody forms.
- Assist the PM in tracking the schedule and performance of the sampling and analysis activities according to this SAP.
- Assist with sampling efforts and sample processing.

2.6. Field Safety Officer

John Gauthier is the Field Safety Officer (FSO). As a former commercial diver, John is extremely knowledgeable of over-water safety requirements. John serves on GSI's corporate safety committee and is well suited for this project role. As the FSO, John will ensure that the sampling activities adhere to the HSP and are in general compliance with 29 Code of Federal Regulations (CFR) 1910.120 and 1926. He will also assist with IDW management as required.

2.7. Field Support

Subcontractors anticipated to be used to support this work are listed below by work type:

- **Sub-Bottom Profiling Subcontractor –** David Evans and Associates, Inc., will provide sub-bottom profiling equipment and conduct the survey.
- **Marine Subcontractor -** Marine Sampling Systems, LLC (MSS), will be retained for the SPI survey, power-grab surface sediment sampling, and over-water Vibracore drilling activities.
- **Sonic Drilling Subcontractors -** Cascade Drilling will provide a sonic drill rig and core sampling equipment and crew to support over-water drilling activities. Marine vessel equipment will be provided by Diversified Marine.
- **Cultural Resource Subcontractor -** Willamette Cultural Resources Associates, LTD (Willamette CRA), will provide cultural resource training to field staff before sediment sampling begins and will provide monitoring services, as necessary, during sediment sample collection.

2.8. Data Validation and Management Support

- **Chemistry QA Manager -** James Mc Ateer of QA/QC Solutions, LLC (QA/QC Solutions), will be retained to serve as the Chemistry QA Manager for the project and to conduct a third-party QA review (data validation) of the analytical data. QA/QC Solutions will add qualifiers, as needed, to the electronic data deliverables submitted by the primary contract laboratory and provide the validated laboratory results to GSI for incorporation into the project database.
- **Data Management –** Elysse Alexander, a database manager with GSI, will be the project Data Manager (DM). The DM will maintain the project database and will coordinate directly with the project team including the Chemistry QA Manager and analytical laboratories, as needed, in accordance with the DQMP (Appendix C). The DM will verify the satisfactory electronic transfer of validated data, maintain the integrity of the database, and oversee all data queries and reporting.

2.9. Laboratory Services

APEX Laboratories (APEX) of Tigard, Oregon is the primary laboratory for this Phase I RD Investigation. APEX maintains laboratory certification under Oregon Environmental Laboratory Accreditation Program (ORELAP ID: OR100062). APEX will coordinate all subcontracted laboratories. Analysis of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

(PCDD/F) congeners will be subcontracted to Cape Fear Analytical, LLC. High-resolution pesticide analysis will be performed by Bureau Veritas Laboratories (formerly Maxxam Analytical) in Ontario, Canada. Eurofins Calscience, Inc., of Garden Grove, California, will perform the tributyltin analysis. ALS Laboratories in Kelso, Washington, will analyze the bulk sediment samples for design as well as implementation-specific properties, as described in Section 5. All subcontract laboratories are certified under Oregon's Environmental Laboratory Accreditation Program. Lisa Domenighini of APEX will serve as the Laboratory Project Manager to oversee laboratory performance in accordance with the QAPP.

3. Sampling Approach

To support development of the investigation approach, the Site was organized into six sample areas (Table 3-1; Figure 3-1). This organization is based on unique physical conditions and the specific data needs for each of these areas. Table 3-2 presents a summary of the overall sampling program including the rationale and scope of sampling in each sampling area. These sampling areas are referenced throughout this SAP to assist the project team and field personnel in understanding specific objectives and sampling requirements to meet those objectives. Alternative forms of compiling the data, such as by project area, will be considered during RD.

The target sampling locations within each area are shown on Figures 3-1 to 3-6. The upriver Areas 1 through 4 encompass the main SMAs at the Site. These areas include the active shipping operations, in-water structures, and remnant pile fields. Surface sediments in Areas 1 through 4 are generally finer-grained materials. Area 5 is unique because it underlies or is adjacent to the former Stan Herman warehouse building. Area 6 was identified as a unique area because it is separate from the upriver SMAs, and the sediments are coarser grained than sediments found in Areas 1 through 4, typically consisting of cobbles interspersed with fines in the ripples. The prior sample recovery results from grab sampling were considered during the development of this SAP.

Consistent with the BODR, the primary project objectives for this Phase I RD sampling are the following:[4]

- Refine RM11E Sediment Management Areas (SMAs) (described in Section 3.1)
- Verify Area 6 CSM (described in Section 3.2)
- Characterize the DOC of the Target Material to allow development of dredge prisms for the alternatives evaluation and RD (described in Section 3.3)

The following sections describe the technical approaches to collect data to meet these three primary objectives. In addition to meeting these objectives, collection of bulk sediment data for disposal characterization and treatability testing is needed. The bulk sediment sample collection approach is described in Section 3.4. The detailed methodologies for sample collection and handling are presented in Section 4 of this SAP.

3.1. SMA Refinement Sampling

Refinement of the SMA footprints is necessary because the river system is dynamic and a portion of the surface sediment data that define the SMAs were collected nearly a decade ago. Additionally, a major warehouse fire occurred along the shoreline in 2017 and a complete characterization of soil and sediments resulting from the fire was not conducted by the responding parties. Based on these conditions, the following primary objectives for SMA refinement sampling were developed:

[4] Riverbank soil sampling and characterization adjacent to SMAs will be conducted in Phase II. Verifying the Area 6 CSM was not originally part of the BODR objectives for Phase I RD sampling.

- Refine the outer (riverward) margins of the SMA footprints in Areas 1, 2, 3, and 4 where subsurface sediments are below RTs and existing surface data for COCs above RTs are outdated.
- Refine the SMA footprint at the southern (upstream) end of the RM11E Project Area (Area 1) where the current sample density is insufficient for detailed mapping of the southern SMA boundary.
- Assess for the presence and magnitude of PCDD/Fs in the footprint of the former Stan Herman warehouse (Area 5) to determine whether an SMA is present.[5]

To meet these objectives, a total of 23 sediment grab stations will be sampled at locations shown in Figure 3-2. The approach and rationale to the SMA refinement samples are presented in the following subsections.

3.1.1. SMA Refinement Analyte Selection

The analytes for the SMA refinement sampling will be limited to only those COCs that historically exceeded RTs in surface sediments. These consist of total PCBs and PCDD/F congeners, herein referred to as "Driver COCs." Driver COCs were also discussed in a conference call on February 14, 2020, with EPA and RM11E technical staff. In the conference call meeting, EPA concurred that the cleanup at RM11E will be driven primarily by total PCBs and by specific congeners of PCDD/Fs. As discussed below, DDx and PAHs are not Driver COCs at RM11E, despite single-sample RT exceedances.

In order to support the elimination of DDx as a Driver COC at RM11E, the RM11E Group is providing a point-by-point evaluation of DDx concentrations. For the 10 archived sediment samples that were reanalyzed in 2013 using the high-resolution pesticide method (EPA 1699M), the high-resolution results were used in the evaluation and subsequent mapping. For other sample locations, conventional method results were used. The results confirmed only one sample location (LW3-GCA11E-C00), analyzed by the conventional laboratory method, still had a DDx RAL exceedance. All other DDx laboratory results using conventional and high-resolution analysis (where available) are below applicable RALs in the RM11E Project Area. Because only one sample showed a RAL exceedance for DDx, the RM11E Group did not attempt to correct the entire data set for analytical bias. The LW-3-GCA11E-C00 sample location is within the PCB SMA footprint and therefore will be subject to further investigation and remediation. In order to confirm that this apparent DDx RAL exceedance is a result of analytical bias, the RM11E Group will collect a co-located sediment sample (RM11E-G110) in the immediate vicinity of LW3-GCA11E-C00 and analyze it using the high-resolution pesticide analysis (EPA 1699M). See Attachment 2 for further details.

During the February 14, 2020, conference call meeting, EPA also agreed that laboratory evaluation of sediment for PAHs based on a single RAL exceedance (SL004) is not required for Phase I RD sampling. PAH sample SL004 was a targeted shoreline soil sample collected from a

[5] Two samples (G119 and G120) are above elevation +13 NAVD 88, which is considered the boundary between upland soil and in-water sediments. The separation between soil and sediments at +13 NAVD 88 was used throughout the RI/FS, as well as the first six years of work at RM11E. Elevation +13 NAVD 88 was used in EPA-approved RM11E project documents, such as the BODR and Recontamination Assessment (DOF and GSI, 2019 and GSI and DOF, 2018, respectively).

location that may have been affected by creosote (as indicated in the photograph log, Appendix B of the Bank Soil and Debris Field and Data Report [GSI, 2010b]). It was also noted that sample SL004 is a bank soil sample and not a surface sediment sample.

Based on the above, the Driver COCs for the RM11E Project Area are PCBs and PCDD/Fs. They are the COCs that are present in surface and subsurface sediment at concentrations greater than RTs. However, for this Phase I RD sampling, not all samples will be analyzed for both total PCBs and PCDD/F congeners. The rationale and logic for varying the analytical protocol in the various sampling areas are described in the following subsections and presented in Section 5.2.

In addition to PCBs and PCDD/Fs, all surface sediment samples will be analyzed for total organic carbon (TOC), total solids, and grain size. The data replacement/integration approach for the new Phase I RD sample results with historical samples will be developed in consultation with EPA during the alternatives evaluation and 30% Design, based on evaluation of the Phase I analytical results.

3.1.2. Areas 1-4 – Refine Riverward Margin in Main SMA

In Areas 1, 2, 3, and 4, the SMA is defined by both surface and subsurface sediment contamination that historically exceeded the RTs for total PCBs and/or at least one of the PCDD/F congeners. The proposed sampling stations target areas where past sampling results indicate that surface sediment concentrations exceeded the RTs, but subsurface sediment concentrations were below the RTs. Where existing subsurface sample concentrations exceeded RTs, surface sediment SMA refinement will not be conducted. The number and spacing of locations were selected to provide adequate density to refine the riverward SMA boundaries as necessary. Samples were placed on an approximate 150-ft grid spacing.

Figure 3-2 shows 13 locations (G105 through G117) in Areas 1 through 4 targeted to be riverward SMA refinement samples. All of these samples except for G105, G106, G107, and G110 are located in the navigation channel. (Note: The five samples at the southern end of Area 1 [G100 through G104] have a different objective and are discussed in Section 3.1.3). All surface sediment samples in Areas 1 and 4 will be analyzed for both PCB Aroclors and PCDD/F congeners based on past sampling data and RT exceedances.

The riverward surface sediment samples in Areas 2 and 3 will be analyzed for PCB Aroclors only, because that chemical group is the historical driver of the riverward SMA footprint in these areas. Sample RM11E-G110 will also be analyzed for DDx to confirm that the co-located historical result was biased high and there is no DDx RAL exceedance at that location.

Note: While there have been historical RT exceedances of PCDD/Fs in Areas 2 and 3, the sample locations where these RT exceedances occurred are located near the shoreline, which is not the target location for this sampling objective (i.e., riverward SMA refinement). PCDD/Fs are included in Areas 1 and 4 surface sediment samples because of several historical PCDD/F RAL exceedances in these sample areas that occurred adjacent to the navigation channel. As a reminder, PCDD/F will be run in all subsurface cores and remains a Driver COC for this Phase I investigation.

3.1.3. Area 1 – Refine SMA Footprint at Southern Extent of Project Area

As shown in Figure 3-2, five (5) surface sediment samples (G100 through G104) are targeted for the southern portion of Area 1. The objective for these samples is to refine the SMA footprint in

this area. Due to low sample density from the prior investigations, there is uncertainty in the southern extent of this portion of the SMA; therefore, the extent of the SMA will be confirmed prior to RD. These samples will be analyzed for PCDD/F congeners and PCB Aroclors only. PCDD/Fs produced much of the apparent SMA footprint in this area, with no total PCBs greater than RTs present (GSI and DOF, 2018).

3.1.4. Area 5 – Fill Data Gap in Stan Herman Warehouse Footprint

Area 5 is located in the immediate vicinity of the former Stan Herman warehouse that was destroyed by a fire in 2017. EPA conducted an emergency response action following the fire and collected soil and sediment samples from the area to evaluate the post-fire shoreline conditions. The RM11E Group evaluated the EPA data and identified PCDD/F RT and ROD cleanup level (CUL) exceedances in the unarmored riverbank soil (RM11E Group, 2018). EPA did not conduct an analysis of PCDD/Fs in sediments. The non-delineated nature of the PCDD/F RT and CUL exceedances in this area is viewed as a data gap for the RD. The sample locations consist of a linear array of five surface samples (G118 through G122) that will be analyzed for PCDD/F congeners and physical parameters. The PCDD/F results will be compared against RTs to determine whether remedial action is required in this area. Other COCs were evaluated in a RM11E letter to EPA and DEQ dated August 21, 2018 (RM11E Group, 2018).

3.2. Area 6 CSM Verification

The sampling objective and approach for Area 6 is designed to verify the Area 6 CSM by further evaluating the thickness and lateral distribution of soft sediments overlying the native gravel substrate. This physical characterization will support the evaluation of potential remedial technologies for this area during RD. The physical characterization data will be supplemented by chemical analysis of the upper 2 ft of material to confirm that the native gravel substrate is not impacted to levels above RTs. This provides an additional line of evidence to help identify requirements and appropriate approaches to meet ROD requirements in this area. Descriptions of the four main tasks are presented below.

3.2.1. Sub-Bottom Profile Survey

Three sub-bottom profile transects will be conducted in Area 6. Further details regarding methodology are provided in Section 4.4. Sub-bottom profiles (cross sections) will be recorded along two longitudinal transects parallel with the shoreline and one transect perpendicular to the shoreline (Figure 3-3).

3.2.2. Sediment Profile Imaging Survey

To complement the sub-bottom profiling, a SPI survey will be conducted at approximately 24 locations on a 75-ft rectangular grid (Figure 3-4) to measure sediment thickness to a depth of up to approximately 8 inches. The SPI equipment can also record a plan-view video image of the sediment surface, if water clarity allows. Portions of the SPI grid will be co-located with the sub-bottom transects to provide comparative information to assist in interpretation of the results. Further details regarding methodology are provided in Section 4.5.

3.2.3. Sonic Drilling

As shown in Figure 3-5, five (5) sample stations are proposed in Area 6 (C109 through C113), which will be sampled using sonic coring techniques. Area 6 is approximately 1 acre in size. Previous sampling episodes to collect surface sediments in Area 6 have revealed predominantly gravels and cobbles, which are unlike the finer sediments found in other upriver sampling areas. This area has historically been difficult to sample using typical Portland Harbor surface sampling methods (power grab), due to the predominance of gravels and cobbles. Sonic coring was selected to collect samples in this area to provide a more robust approach to collect representative samples.

A modified approach was developed for Area 6 to allow calculation of the bulk sediment concentrations based on grain-size distribution and chemical analysis of the fine-grained fraction. This approach, described in detail in Section 5.2.2, will provide representative concentration information that will be useful in determining the remedial approach for this downriver area during RD.

3.2.4. Data Reduction and Reporting

Information from these tasks will be incorporated into the RM11E Phase I RD Sampling and Data Report describing the outcome of the data collection tasks, updating the Area 6 CSM, and identifying additional sampling, if needed, to refine the definition of the Area 6 SMA. This information would also support the RD to determine the appropriate remedial technology in Area 6. If additional data gaps are identified through the design process, an additional round of characterization in Area 6 will be considered, as required, during Phase II investigations.

3.3. DOC/Dredge Prism Design Sampling

The purpose of the subsurface sampling is to refine the horizontal and vertical extent of the Target Material at the Site and to aid in defining dredge prisms during RD.[6] Because prior sediment coring programs at the Site were completed years before the ROD was issued, RALs were not established at that time. Therefore, the DOC has not been determined at many locations in accordance with the ROD. In addition, at several prior coring locations, the deepest sample collected exceeded RTs. Consequently, the full DOC has not been established in these areas. Subsurface data will also be considered in future SMA refinement.

Subsurface sediment samples will be collected at 59 stations in Areas 1 through 4. A map showing these locations is presented in Figure 3-5, and the rationale for their selection is provided in Table 3-2. The subsurface sampling procedures and methodology are described in Section 4.7.

The remainder of this section describes the rationale for sample location, depth, and analytes.

3.3.1. Spatial Considerations and Depth

Much of the RM11E SMAs are located on steep side slopes that extend from the riverbank to the face of the docks. The contact elevation between the Target Material and the underlying native

[6] Additional characterization of the horizontal and vertical extent of Target Material will be completed under a Phase II SAP.

material on the slopes changes for locations down the slope. An understanding of the three-dimensional character of the extent of Target Material is needed to develop a three-dimensional dredging plan to capture that material. In order to better define the DOC across variable conditions at the Site, the Phase I subsurface sampling program is based on the following:

Slope Transects. To measure Target Material thickness, cores are located on transects down the fall line of the steep slope, targeted at four elevations:

- +10 ft NAVD 88: in the Shallow zone
- -10 ft NAVD 88: in the upper Intermediate zone
- -30 ft NAVD 88: in the lower Intermediate zone
- In the Future Maintenance Dredge area[7]

An outcome of this approach is that, on the steep slopes, the sample locations are closely spaced when shown in plan view (see Figure 3-5). However, the sediments will be collected from very different elevations, which is a critical component of design-level characterization for the Site.

Transects at 150-ft Centers. EPA's Remedial Design Guidelines and Considerations (RDGC) suggests sample spacing in a 150 ft-by-150 ft grid (EPA, 2020). For the highly variable elevations associated with the sloping site conditions at RM11E, transects have typically been spaced approximately 150 ft apart. In Areas 1 through 4, the sampling stations are based largely on a grid-and-transect approach to define the DOC of primary COCs within areas of known subsurface contamination. Retrieved cores are anticipated to be up to 10- to 25-ft in length (depending on the conditions encountered or until refusal, and except in Area 6) and will be sectioned into 1-ft intervals for sampling, consistent with EPA's RDCG (EPA, 2020). Because dredging will be a primary element of the remedy at the Site, the data from the subsurface coring program will be critical to define the vertical and horizontal extents of Target Material, which are necessary to inform for completing the RD.

3.3.2. Analyte Selection

Consistent with EPA's RDGC, cores will be segmented into 1-ft sample intervals. A systematic tiered analytical approach will be implemented using total PCB Aroclors as an indicator of an RT exceedance to determine the DOC. Once the DOC is defined, a sample collected from below the DOC will be analyzed for PCB Aroclors and PCDD/Fs. Additionally, at 10 locations (selected to have one representative sample per acre for a Site that is approximately 10 acres), a sample representing the post-dredge leave surface will be analyzed for all ROD Table 17 sediment COCs to document the anticipated surface sediment concentrations that may be left in place following dredging. The tiered analytical approach is described in Section 5.2 and illustrated in Figure 5-1.

[7] Future maintenance dredge areas are defined in the ROD (EPA, 2017).

3.4. Bulk Sediment Sampling for Remedial Action Evaluations

Bulk sediment samples are required for disposal characterization, elutriate testing, and bench testing for sediment treatability and handling properties. Specific objectives of the bulk sediment sampling are the following:

- **Disposal Characterization.** Samples of bulk sediment will be tested by the toxicity characteristic leaching procedure (TCLP) for site-specific metals (chromium and lead) as specified by the Resource Conservation and Recovery Act (RCRA) to characterize dredged sediments for disposal characteristics. Sediment will also be analyzed for TOC and grain size.
- **Dredging Elutriate Testing.** Elutriate water samples from bulk sediment will be analyzed by the Dredging Elutriate Test (DRET) to evaluate the potential for COCs to partition to the water column for determination of dredge water characteristics for handling and disposal requirements.
- **Treatability Testing.** Site water mixed with bulk sediments will be dosed with various coagulants and flocculants to identify effective agents and dose rates to reduce total suspended solids in water associated with dewatering dredge material.
- **Dewatering and Stabilization.** Samples of bulk sediments will be mixed with different amendments (e.g., Portland cement and ZapZorb) to identify effective amendments and dose rates to dewater and/or stabilize dredge material as needed for transportation and/or disposal of dredged material.

The bulk sediment samples will be composites of the full sediment profile to the estimated DOC and be developed from sediment cores collected at the same time as, and collocated with, the dredge prism design samples discussed in Sections 3.3 and 4.8 (Table 3-3). The sampling approach consists of preparing three composites, each made up of five individual cores to provide a representative sample of the sediments that may be removed during remedial action. The sample depth at each individual core making up the three composites will be based on the estimated DOC of PCBs determined from the prior sampling at the Site (GSI, 2014). The three bulk sample area boundaries and the five target cores within each bulk sample areas are shown in Figure 3-6. (Note these bulk sample areas differ from the six sample areas described previously because the objectives for the bulk sediment sampling are distinctly different from the objectives for SMA delineation and dredge prism design).

The three composited bulk samples represent the primary volumes of Target Material at the Site. The results of the bulk sample testing, in combination with the extensive data set of discrete COC sampling at the Site are sufficient to characterize the material for the stated objectives. Should Area 6 be shown later to require dredging, then the COC data from Area 6 would be evaluated to determine whether the results of the three bulk samples are sufficiently representative of the conditions at Area 6.

The DRET test results will be used in combination with the treatability testing to develop requirements for dredge water clarification. The purpose of the DRET is to indicate the potential

for COCs to partition into the water column during dewatering or dredging. The results can also be used (1) to understand the nature of water quality conditions during dredging and (2) in for preparing a Clean Water Act Section 401 Water Quality Certification, if deemed necessary by the State of Oregon.

The physical testing and analytical programs supporting the bulk sediment sample testing are presented in Section 3 of the QAPP.

4. Field and Sampling Activities

4.1. Change Management

Due to the extensive sampling and variable conditions at the Site, some changes to the sample locations and methodologies described in this SAP may be required during the course of the field program. Details describing the planned contingency adjustments to accommodate variable field conditions are discussed in Section 4.6.2 for surface sediment sampling and in Section 4.7.4 for subsurface coring. To keep the project moving forward smoothly and efficiently, the following protocols for change management, documentation, and communications with EPA will also be used:

Field Decisions and Documentation. Many field adjustments provided for under this SAP in Sections 4.6.2 and 4.7.4 will be reported by the field teams to the PM for consultation and determination of the appropriate response. This category of field adjustments includes moving a sample location due to obstacles or refusal, modifying target depths or acceptable sample recovery at core locations, and other routine field decisions that are common in a large sediment investigation field effort. When these arise, the field team and PM will generally take appropriate actions without a requirement to elevate these daily decisions to the PD or EPA. However, any deviations from this SAP and beyond the allowable contingencies described herein will be documented in the field (see Field Change Request Form in Attachment 3) and provided to the PD and EPA immediately.

4.2. Navigation and Station Locating

The target sample location coordinates (e.g., easting and northing) are presented in Table 4-1. The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD 83), State Plane Coordinate System, Oregon North Zone. Station coordinates in Table 4-1 will be pre-loaded GPS units to facilitate proper location of the samples by the field teams. The positioning objective is to determine and record the horizontal field positions of all sampling locations to within ±3 ft. GPS precision and accuracy will be confirmed and recorded each morning and evening at an EPA-approved fixed surveyed benchmark (that is to be determined).

For the power-grab and Vibracore sampling (see Sections 4.6 and 4.7), the marine sub-contractors in coordination with the onboard field sampling staff will position the support vessel and power-grab sampler as close as practical to the target sample location and hold the vessel in place (hover) during sample collection. No anchors are used, which requires that the captain hold the vessel in position with the boat motors. The latitude and longitude coordinates of the sample will be obtained by a GPS unit positioned directly above the sampling instrument when the equipment is on the river bottom.

For sonic drilling and sampling (see Section 4.7), a spud barge will be used to deploy a sonic drilling rig to each sample location. The barge will be positioned to the sample station using a GPS unit mounted on the drill rig. Once in position, the spuds will be slowly lowered until firmly pushed into the sediment bed to hold the barge and rig in position.

4.2.1. Vertical Positioning

Vertical positioning is required to establish the elevation of the mudline at the sample locations. This is accomplished using a pressure transducer attached to the sampling equipment or with a lead line, as needed, if complications arise with the pressure transducer. Vertical measurements to the mudline below the water surface will be recorded to the nearest 0.1 ft. Water surface elevations in NAVD 88 will be measured with a tide board (survey gauge) affixed to a RM11E waterfront structure and registered for direct reading of water surface elevations, or by a pressure transducer installed in a stilling well at a RM11E waterfront structure and registered to NAVD 88. Water surface elevation readings will be recorded periodically while sampling and used in combination with water depth readings to calculate mudline elevations at sample locations.

4.2.2. Establishing Final Sample Coordinates

Experience has demonstrated that the horizontal coordinates measured from the vessel using GPS (described above) may not accurately reflect the actual sample locations on the riverbed. Factors contributing to this include drift of the sampling device in the flowing water column as it is lowered from the vessel and/or slippage of the device when it contacts steep submerged slopes or encounters debris. To assess this uncertainty, each field-measured horizontal location will be plotted onto the high-resolution bathymetry map, and the projected bed elevation on the map at that point will be compared with a field-measured bed elevation (vertical positioning). If the bed elevation projected on the bathymetry map at that location differs from the field elevation measurement by more than 0.5 ft, the horizontal coordinates will be adjusted to align with the field and bathymetry bed elevations to within 0.5 ft. The horizontal coordinates corrected for measured bed elevation will be recorded in the sampling database.

4.3. Sample Identification and Container Specifications

All samples will be assigned a unique identification number. The unique identifier will consist of up to five components, separated by dashes ("-"), which will indicate the sampling event, station number, sample type, and field QC sample type (if applicable):

- The first component is "RM11E," identifying the data as belonging to the RM11E sampling event.
- The second component begins with a "G"to represent a grab surface sediment sample type, or a "C" to represent a subsurface sediment core sample type. The letter will be followed by the unique station identification number representing a continuation of the numbering order and naming convention consistent with previous RM11E investigations. For surface sediment samples, the station number will begin at 100. For subsurface sediment cores, the station number will begin at 050.
- For subsurface sediment cores, the sampling interval will also be noted from the top to bottom depth of the sampling interval, in ft.
- For bulk sediment samples, the sample from each core within an area will be identified by area ("A1", "A2", and "A3") followed by the core ID ("1" through "5"), followed by the depth interval in ft (e.g., "A1-1-0-5"). The composited sample from a representative area will

be identified by the area ID followed by "C" for a composite (e.g., "RM11E-A1C"). No field splits will be collected for these samples.

Examples of the unique sample identifiers are as follows:

- RM11E-G100: Grab sediment sample from Station 100
- RM11E-C050: Subsurface sediment core location from Station 050
- RM11E-C050-0-1: Subsurface sediment core sample from Station 050 from 0 to 1-ft sampling interval

The final component, if applicable, identifies the QC sample type. For split samples, a number of 5000 will be integrated with the station number of the original sample. For equipment rinsate blanks, a number of 9000 will be integrated with the station number.

Examples of the unique sample identifiers are as follows:

- RM11E-G5100: Split grab sediment sample from Station 100
- RM11E-G9100: Equipment rinsate blank sample during collection of grab sample from Station 100

4.3.1. Sample Containers and Handling

Table 4-2 presents the list of analytes, sample containers, and preservation and holding times for this sampling program. All containers will typically be assembled and labeled prior to each day's field event. The specific analytes for each sample type are presented in Section 5. Samples will be placed in proper containers and stored on ice during the workday to keep temperatures at approximately 0 to 6°C. Samples will be shipped to the laboratory on a frequent schedule dependent on sample volume.

4.3.2. Field Logbook and Forms

The daily field activities and observations will be documented in a field logbook. Information will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur at the Site (e.g., personnel, responsibilities, deviations from the SAP) and the reasons for the changes will be documented in the field logbook.

Field data sheets and sample description forms will be completed for all samples and kept in the project file. Depending on the activity, the type of field data sheet and the information recorded on it may vary. Sample field forms are provided in Attachment 3.

4.4. Sub-Bottom Profile Surveying

Sub-bottom profiling is a vessel-deployed acoustic technology that sends a signal vertically downward through the water column. A receiver measures the return signal that is reflected off of various sediment/geologic layers in the riverbed below the mudline. This technology produces a cross section along each transect. Each cross section shows the layers in the riverbed and can be used to estimate the varying thicknesses of each layer, including the gravel substrate and the upper finer-grained sediments. The instrument will be tuned (for frequency and

sensitivity) as needed to determine the thickness and lateral distribution of soft sediments overlying the gravel substrate.

4.5. SPI Surveying

Proposed SPI and video sampling to determine the areal and vertical extent of soft sediments in Area 6 will consist of the deployment of a SPI landing frame with attached videocamera(s). The landing frame consists of a proprietary frame and hydraulically powered insertion system that uses an Ocean Imaging Systems 3701 sediment profiling camera and prism. The SPI camera and prism are depth-rated to 1,000 ft. The SPI camera system collects a photograph of the sediment column in profile, typically of up to 20 centimeters (cm) (8 in) of the upper portion of the sediment column. The target depth of image capture is 20 cm, however the final depth at each location will be determined in the field, dependent upon on specific conditions on the riverbed (i.e., soft sediments versus gravel) at each location. The SPI system uses a Nikon D7200 digital single-lens reflex camera to record a high-resolution 24.2-megapixel image.

To insert the periscope-like SPI prism into the sediment column, MSS has developed an actively powered SPI frame in which a hydraulic piston is used to drive the prism into the sediment column with up to 1,200 pounds of downward force. This frame was developed specifically for use in coarse and compacted sediments. The rate and depth of penetration is controlled by the SPI operator who has a live video feed of the prism from the vessel. The depth and time of SPI image acquisition is also controlled by the SPI scientist using a remote trigger from the vessel. The interval or specific depth of image capture is user-defined, based on sediment type, environmental conditions, or specific project goals.

As the SPI system looks at the sediment column in profile only (like an optical shallow core sample) a real-time video system attached to the SPI system in a plan-view orientation will be used (if water quality allows) to determine the areal extent of surficial fine sediments. The real-time video allows for the identification and delimiting of the distribution of fine sediments at the sediment/water interface. The SPI system will allow for the measurement of thickness of those deposits. The proposed video system will be an Outland Technologies fixed-focus 3501 composite video system with scaling lasers and two 2,000-lumen light-emitting diodes with user-controlled intensity. Additionally, a modified action-camera housed in a GoBenthic 2,000-meter depth-rated housing will collect high-definition 30 frames-per-second video along with 12.3-megapixel plan-view images.

4.6. Surface Sediment Sampling

Twenty-three (23) stations are identified for collection of surface sediment samples, as shown in Figure 3-2. These will be three-point composited grab samples with a target penetration depth of 30 cm below the mudline and a minimum acceptable penetration depth of 20 cm.

Surface sediment sampling will include the use of two types of grab samples: power-grab and manual-grab. The best device for each particular circumstance will be deployed. Analytes for surface sediment sampling are presented in Section 5.2. Containers for these analytes are presented in Table 4-2.

4.6.1. Power-Grab Sampling

Surface sediment samples collected from open water in Areas 1 through 4 shown on Figure 3-2 will be obtained by MSS using power-grab sampling methodology consistent with previous work at the RM11E Site. In Area 5 (the Stan Herman warehouse), the two most riverward samples (G121 and G122) will be collected using the power-grab sampler. The other three samples in Area 5 (G118, G119, and G120) will require the manual collection techniques (described in Section 4.6.3) because of the presence of remnant piles and higher elevations that prevent access by a sampling vessel.

Sediments recovered by the power-grab sampler will be inspected for acceptance by field staff. Sample acceptance criteria include the following:

1. No (or minimal) loss of sediments due to obstructions preventing sampler jaws from fully closing.
2. No (or minimal) excess water leaking from sampler jaws.
3. No (or minimal) turbidity in overlying water in sampler.
4. No over-penetration of sampler.
5. Sediment surface appears to be intact with minimal disturbance.
6. Target recovery of 20 cm or higher is achieved.

Although substantial soft sediments are not expected, the condition of retrieved samplers will be observed for indications of over-penetration, such as mud on the exterior of the sampler. Equipment settings will be modified where possible to reduce or eliminate over-penetration.

4.6.2. Contingency Plan for Power-Grab Samples

During sampling efforts, the field team may encounter conditions that may impede the collection of samples at planned locations. This may include access issues, poor recovery, safety concerns, or substrate/debris causing refusal. In each instance, the field team will document each attempt.

In areas where conditions do not allow a 20-cm recovery or more, after three attempts within a 25-ft radius of the target location, up to three additional attempts will be made within a 50-ft radius of the target location, for a total of up to six attempts per sample station. The field team or PM may recommend additional attempts based on professional judgment, in accordance with Section 4.1. In areas with no acceptable recovery (< 20-cm recovery) due to bedrock, riprap, dense/cemented cobbles, up to three attempts will be made and no more. The field team will document the attempts and follow protocols described in Section 4.1. An alternative location may be selected if discussions with EPA deem it necessary.

4.6.3. Manual-Grab Sampling

Where accessible, surface sediment samples from Area 5, the former Stan Herman warehouse, will be collected by field staff using manual sampling equipment appropriate to the field conditions encountered at the time of sampling. The target sample interval will be from 0 to 30 cm in depth.

4.6.4. Sample Collection and Processing

The GPS coordinates for an accepted sample will be recorded. A photograph of each undisturbed grab sample will be taken prior to processing. A representative composite of the full recovery depth will be collected from each sample. In fine sands, silts, and clay, sediment samples will be collected from the power-grab bucket by manually driving a 2-in-diameter coring device (e.g., stainless steel, aluminum, or high-density polyethylene [HDPE] tube) through the center of the grab sampler and collecting material representative of the full depth of the sampler. For manual-grab samples or where gravels or other obstructions are present, samples will be collected manually using a stainless-steel spoon, removing material through the full depth of the sampler. Sediments that are in contact with the sides of the sampler will be avoided. Large rocks, organisms, and pieces of debris will be removed and noted in the sample description form. Any observations of sheen will also be recorded.

A representative sediment sample from each accepted subsample will be placed into a stainless-steel mixing bowl for logging. Prior to mixing, the following physical characteristics of the grab samples will be described and recorded on a sample description form following the ASTM D2488 visual soil classification procedure. This procedure includes describing sediment texture; sediment color; the presence, type, and strength of odors; grab penetration depth (to the nearest cm); and any obvious features or characteristics, such as wood, shell fragments, or organisms. When a consistent color and texture has been achieved, each subsample will have material collected for archival. Once all three subsamples are collected and homogenized, equal-volume aliquots from each will be mixed into one composited sample representing the location. After the sample is thoroughly mixed, the required amounts will be transferred to the appropriate sampling containers identified in Table 4-2.

4.7. Subsurface Sediment Sampling

Through past investigations, it has been determined that the sediment textures are highly variable at the Site. The north (downriver) portion of the Site tends to have coarser sediments with gravel and cobbles. In contrast, sediments in the southern extents are finer grained. To prepare for this variability, multiple drilling and sampling methods, described below, will be used as needed. Initial assigned drilling methods by sample location and target drive depths are presented in Table 4-3.

In addition, a tiered laboratory analytical program will be implemented to determine the DOC required for dredge prism design. Section 5.2 of this SAP and Section 2.1 of the QAPP describe the tiered approach in detail. Sample containers and preservation and holding times are presented in Table 4-2.

4.7.1. Vibracore Sampling

In the southern portion of the project area, where fine-grained sediments are predominant, cores will be targeted for collection using a customized Vibracore deployed from the sampling vessel operated by MSS. This consists of a wireline-suspended hydraulic system that vibrates and drives a 15-ft long, 4-inch-outside-diameter aluminum core tube into the sediments. A continuous sediment sample is retained within the tube with the aid of a stainless steel retainer attached to the bottom of each aluminum tube. A core liner may be used with this device.

Following positioning at a given sampling station, the Vibracore will be deployed off of the foredeck of the vessel and slowly lowered to the sediment surface. The core tube will be advanced to obtain adequate core penetration (target sample depth or to refusal). The core penetration depth will be estimated by means of a pressure transducer attached to the top of the core barrel, presented in more detail below. The core penetration depth and physical characteristics (e.g., color, texture, and odor) of the sediment core as observed at the ends of the tube will be recorded on field log sheets. Any presence of sheen at the end of the tube or in the water also will be noted.

From past work at the Site, it is recognized that in some locations, the Vibracore may not be effective at reaching the target sample depth or retaining material due to the presence of gravels and cobbles. Where refusal is met and target penetration is not achieved, the more robust sonic drilling and coring method described in Section 4.7 may be used.

4.7.2. Vibracore Sample Acquisition Measurement

As stated in the RDGC (EPA 2020), EPA has identified a target sample recovery of 80 percent in each core using conventional Vibracore techniques to determine the vertical extent of contamination. Past experience has demonstrated this is often unachievable at the Site. Of the cores that were collected at the Site and where target penetration was achieved within one ft, the historical average percent recovery was 68 percent, and was as low as 40 to 60 percent in many cases. See Figure 4-1 for details regarding historical core recovery.

There are two primary ways to interpret the partial recovery in the core tube: compaction and bottom loss. The following explain compaction and bottom loss by way of an example of a 15-ft core tube advanced into the sediment bed, yielding 10.5 ft (70 percent) of sediments recovered in the tube.

- **Pile Driving or Compaction**. As a Vibracore tube advances downward into the sediment bed, internal friction along the interior wall of the tube creates resistance to the entry of more material at the bottom of the tube. This internal friction can result in partial recovery or prevent sediments from entering the tube. The blockage of material entering the tube is analogous to the installation of pipe piles, which is where the term "pile driving" comes from. When this occurs, there may not be a clear basis to accurately allocate the depth of the partial sample. Allocating the depth of the partial sample may be simplified by assuming that the sample was compacted uniformly along the drive length, and the 10.5 ft of recovered sample represents the full depth a 15-ft. core with a 70 percent overall recovery.

- **Bottom Loss**. A second explanation of partial recovery is that sediment fell out of the bottom of the core tube as it was retrieved. For this example of 70 percent recovery, the 4.5 ft. of unaccounted recovery is assumed to be loss out of the bottom of the tube during recovery, with the remaining 10.5 ft of sediment in the tube representing the upper 10.5 ft of in situ sediment.

In these examples of 70 percent recovery, uncertainty remains in interpreting the sampling data. Depending on how the partial recovery is interpreted, the DOC may be overestimated or underestimated by as much as 4.5 ft. To provide more information to interpret partial sample recovery, MSS has developed an approach to collect incremental measurements of sediments

acquired in the tube during driving, which reduces the uncertainties in interpreting core data for dredge design.

The MSS system consists of a narrow-beam fathometer attached to the coring frame, separate from the core tube. The narrow-beam fathometer is focused downward inside the core tube. The fathometer measures the distance to a reflector on the top of the sediments inside the tube. This distance decreases as sediment fills the tube, providing incremental data of sediment recovery to correlate with the measurements of core tube penetration into the riverbed. The incremental measurements of sediment acquisition in the tube are repeated during full advance of the core tube. The sediment acquisition and core tube penetration data are plotted to provide a basis for interpreting the true depth of the recovered sediment in the core tube.

The following example demonstrates how the acquisition system addresses both compaction and bottom loss (see Figure 4-2):

- **Pile Driving or Compaction.** Incremental acquisition data is collected during advance of the core tube so that the contribution of pile driving or compaction to sample recovery can be established for each increment of advance. For example, assume acquisition data is collected every 3 ft of advance of the core tube into the riverbed with the following measurements:

    - 2.6 ft of sediment acquired in the first 3 ft of advance (87 percent acquisition),
    - 2.1 ft of sediment acquired in the next 3 ft of advance (70 percent acquisition),
    - 2.6 ft of sediment acquired in the next 3 ft of advance (87 percent acquisition),
    - 1.8 ft of sediment acquired in the next 3 ft of advance (60 percent acquisition),
    - 2.7 ft of sediment acquired in the last 3 ft of advance (90 percent acquisition),
    - With 11.8 ft of sediment acquired in the tube over a 15 ft drive, an average of 79 percent.

    When the core is processed, the depth of sample lengths in the tube can be correlated to in situ depths of sediments. The desired 1-ft in situ depth of samples are correlated to corresponding lengths along the core tube of sediments. In the example on Figure 4-2, an in situ sample depth of 9 ft is represented by the sediment at 7.3 ft in the core tube.

- **Bottom Loss.** Once full depth of penetration is achieved, the acquisition system measures the amount of sediment in the core tube. For example, after 15 ft of penetration, there is 11.8 ft of sediment in the tube (79 percent). After the tube is retrieved from the bed and brought up on deck, the amount of recovered sample is measured; 10.5 ft (70 percent) in the example. From the acquisition data, 79 percent was acquired during advance, 1.3 ft fell out of the tube during retrieval, and the remaining 10.5 ft represents an in situ depth of 13.6 ft.

As the top and bottom of each increment is measured in the core tube, the certainty of the in situ depth represented by the sediment in the core tube is improved considerably as compared with conventional coring. The in situ depth certainty will be estimated as the length of the segment with acquisition data (in this case, 3 ft) times (1 – [acquisition percentage for the segment]). For example, in the case of a 3-ft drive segment with 70 percent acquisition, the in situ location certainty is estimated as 3 ft × (1 – 0.7) = 0.9 ft. The performance standard for subsurface cores collected by Vibracore drilling will be based on the acquisition data, not sample recovery. This

standard is that the recovered interval depth must have less than 1.5 ft of uncertainty from the actual in situ sample interval. This approach lowers the uncertainty encountered in interpreting sample interval depth using percent recovery as the primary measure of acceptability for Vibracore samples.

4.7.3. Sonic Drilling and Coring Sampling

Sonic drilling has a rotating (rotosonic) bit fixed to a continuous rigid drill string that can be advanced downward under power through cobbles and gravels. The sonic drill rig is staged on a spud barge and is moved between locations by a support vessel. Once the desired location is reached, the spuds are lowered to the mudline to anchor the barge and drill in a fixed position. This technique provides the precise horizontal and elevation control required to meet project objectives.

A sampling system created by Cascade Drilling will be used at sample locations unsuitable for Vibracore. The system involves a combination of two primary techniques. The first collection technique is a 3-inch-diameter, 3-ft-long direct-push piston sampler that is driven into the sediment bed in advance of the drill bit to obtain relatively undisturbed samples where conditions allow. The second collection technique is traditional sonic drilling with a 4-in-diameter, 5-ft long core barrel to obtain samples in gravels and cobbles that prevent use of the piston sampler. The combination of these tools on the same drill rig is expected to provide the flexibility to handle the range of sediment conditions that exist at the Site. A memorandum from Cascade Drilling discussing the standard operating procedures for this system is included as Attachment 4.

The field crews will strive to achieve a minimum 80 percent sample recovery using various methodologies; however, for the purposes of this investigation, 70 percent sample recovery will be considered acceptable, consistent with sample recoveries for use of the Vibracore (see Section 4.7.2).

4.7.4. Contingency Plan for Subsurface Sediment Sampling

This section identifies obstacles that may be encountered during subsurface sampling due to field conditions and potential response measures. The primary obstacles that may be encountered during coring include the following:

- The inability to drill at the target location due to an obstruction or from safety concerns,
- For Vibracore drilling, the inability to achieve the target sample depth due to geologic conditions,
- For sonic drilling, the inability to achieve the minimum target sample recovery of 70 percent, and
- Using the acquisition data collected during Vibracore drilling, the resulting in situ sample depth uncertainty exceeds the acceptable criterion of 1.5 ft. or less.

Potential response measures to these obstacles may vary depending upon the specific issue and location of the core within the Project Area. At locations where one or more of these obstacles is encountered, the PM will confer with the lead engineer to determine an appropriate next step to

support the remedial design. The PM and design engineers at DOF will also confer with EPA on the progress of the coring program, any problems encountered, and to identify the appropriate response measure to obstacles encountered. Potential response measures include the following:

- Accept and process the core noting the issues that were encountered.
- Conduct up to three additional attempts within a 25-foot radius at the same location. If the first core attempt meets acceptance criteria, no additional cores will be collected at that station. If the first core attempt does not meet acceptance criteria, up to two additional core attempts will be made and retained. The core with the highest percentage recovery will be retained and processed.
- Relocate the target station within a 50-foot radius of the target location. (Note that the target radius may be modified due to accessibility constraints caused by structures, vessels in berth, or water depth).
- For Vibracore cores, if the target depth cannot be achieved, switch to sonic drilling at that location.
- Defer collection of a core, as needed, at a location to the Phase II RD sampling program.

4.7.5. Sample Collection

The GPS coordinates for the accepted sample will be recorded. Once the core tube is removed from the sampler, it will be capped at the bottom. Overlying water will be carefully decanted from the top of the tube and the total thickness of the sediment retained will be measured (to estimate percent recovery) for core acceptance. Upon acceptance, the core will be photographed and cut into manageable sections (to be determined in the field) aboard the vessel. Each of the core sections will be capped with aluminum foil and plastic caps, sealed with duct tape, and immediately labeled for proper identification and orientation for logging and processing at the onshore facility. Cores will be stored in a vertical position aboard the vessel in a core box and transported (at least once per day) to the onshore facility where they will be stored upright on ice or refrigerated at approximately ≤ 6°C to await processing.

If a core is rejected, the sediment will be returned to the vicinity of the collection site. A new core tube will be used for the next attempt. Core tubes will not be reused.

4.7.6. Sample Processing

Core logging and processing are anticipated to occur concurrently with sample collection at the onshore facility, when possible.

At the onshore facility, each core tube will be fixed to a core-cutting table and cut along the long axis using a circular saw or similar device. The tube will be rotated 180° and cut again. After each core is cut, the entire core tube will be moved to a tray or table and opened. The core tube will be measured for total percent recovery and photographed.

The following physical characteristics of the samples will be described and recorded on a sample description form, following the ASTM D2488 visual soil classification procedure. This procedure includes describing sediment texture; sediment color; presence, type, and strength of

odors; and any obvious features or characteristics, such as wood, shell fragments, or organisms. Any observations of sheen will also be recorded. Collection of sediment touching the walls of the core tube will be avoided as much as possible. The representative sediment sample will be placed into a stainless steel mixing bowl for mixing. After the sample is thoroughly mixed, required amounts will be transferred to the appropriate sampling containers identified in Table 4-2. Samples from every interval in a core will be submitted for archival.

4.8. Bulk Sediment Sampling

Samples for disposal characterization, DRET, treatability testing, and bench testing for sediment handling will be obtained at five stations per bulk sample area as shown on Figure 3-6 and described in Section 3.4. All borings will be advanced and logged using the methods detailed in Section 4.7 as appropriate to the substrate, except as modified below. At each station designated for bulk sediment sample collection, cores will be advanced to the target depth of the estimated DOC shown on Table 3-3. Replicate borings may be advanced next to the first core to ensure adequate sample volume is collected for treatability testing. Recovered material representative of the entire sample depth in all five cores in an area will be mixed into a single sample. Approximately 8 liters (L) (2 gallons) of bulk sediments will be needed for each set of DRET and 3 gallons of sediments for handling/stabilization tests. Site water for all tests will be collected as described in Section 4.9 and in excess of the required volumes. Sediment and water volumes and storage requirements are shown in Table 4-2.

For each of three bulk sample areas (A1, A2, A3), after an acceptable volume of material has been collected at each of the five stations, the sediments will be mixed. Once mixed, subsamples will be divided in the following manner:

- **Disposal Characterization.** A subsample of the bulk sediments for each area will be placed into two 16-ounce wide-mouth jars and one 8-ounce wide-mouth jar. Gravel, large rocks, debris, and/or other detritus will not be placed in the sample container. Sample containers will be capped and shipped to the laboratory for TCLP analysis.
- **DRET.** A subsample of the composited bulk sediments equaling 2 gallons will be placed into two 1-gallon Ziplock bags and shipped to the laboratory for DRET/treatability testing (see the QAPP Section 3).
- **Treatability.** A subsample of the composited bulk sediment equaling 4 L will be placed into 1 L wide-mouth jars and stored in the field lab for treatability testing (see the QAPP Section 3).
- **Sediment Handling Properties.** The remaining of the composited bulk sediments (at least 3 gallons) will be placed into a 5-gallon bucket with a lid and labeled appropriately to be used for handling and stabilization bench testing (see the QAPP Section 3).

4.9. Bulk Water Sample Collection

Site water samples will be collected for use in preparing the sediment slurry for the DRET and treatability testing. Site water will be collected from the middle of the water column and near the center of the Site. A sufficient volume of water will be collected by a pump. Suspended solids will be allowed to settle out (to the extent practicable) prior to using the water for the

tests. One representative sample will be submitted for analysis of the ROD Table 17 Surface Water COCs (Table 5-4). The water sample will be collected prior to drilling and stored on ice.

4.10. Sample Custody and Transport

At the end of each day, samples will be stored in coolers or refrigerators at the onshore facility before shipping/transfer to the primary contract laboratory.

Chain-of-custody and shipping procedures are outlined in the RM11E Focused Sediment Characterization SAP and will follow the protocols outlined therein (GSI, 2009a). Chain-of-custody forms will be completed before samples are transported to the laboratory. Laboratory chain-of-custody procedures are specific to each laboratory and provided as attachments to the QAPP (on DVD only).

4.11. Decontamination Procedures

Equipment that comes in direct contact with samples, such as sediment samplers, scoops, spoons, and mixing bowls, will be decontaminated in the following manner before use at each station:

1. Rinse with potable water or river water to remove visible sediments.
2. Wash with brush and Liquinox or a phosphate-free detergent.
3. Double rinse with distilled water.

Drilling equipment will be decontaminated with a high-pressure steam cleaner/pressure washer before each use. Decontamination water will be captured and stored in U.S. Department of Transportation (DOT)-approved 55-gallon drums, labeled as nonhazardous waste, and stored onsite in a secure upland location pending receipt of the analytical results and appropriate disposal.

For Vibracore and sonic sampling, the aluminum core tubes and stainless steel core catchers will be decontaminated before delivery to the vessel in the same manner as described above, and the ends will be wrapped in foil and sealed onshore before transfer to the on-water operations.

4.12. Investigation-Derived Waste Disposal

Any excess water or sediments remaining on the vessel after onboard processing will be returned to the river near the collection site unless visibly impacted. Similarly, any water or sediments spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station. All visibly impacted sediments (sediments that are markedly discolored, oily, have sheens or petroleum-like odor, or are laden with anthropogenic debris) and water generated during drilling and sampling will be contained in 55-gallon drums. Residual sediments from the core processing operations at the onshore facility will be similarly retained contained in DOT-approved 55-gallon drums or roll-off boxes and sampled to determine appropriate disposal.

Waste personal protective equipment, including used nitrile gloves, will be contained in garbage bags and disposed as municipal solid waste.

4.13. Cultural Resource Monitoring

Willamette CRA will be retained to oversee potential cultural resources found at the Site. A professional archaeologist from Willamette CRA will provide training to GSI field staff to define the types of artifacts and deposits that, if encountered, would require examination and documentation by an archaeologist. This training also will address the material and/or deposits to receive less intensive documentation and the standards for documentation. The archaeologist will be on call during the remainder of sampling activities. If archaeologically sensitive prehistoric or historic artifacts are discovered when the archaeologist is not at the Site (i.e., on call), the PM will contact the archeologist and follow the procedures described in the Plan and Procedures for the Inadvertent Discovery of Human Skeletal Remains and Cultural Resources (Inadvertent Discovery Plan) (Attachment 5). All personnel will follow Oregon State Historic Preservation Office guidelines for known sites and isolated finds (Oregon Revised Statute [ORS] 358.905-358.955) or sites along scenic waterways (ORS 390.805-390.925).

5. Laboratory Analysis

The analytical program for this Phase I RD sampling is variable depending on location, sample type, and objective. The list of analytes for each of the primary sample categories (surface sediments, subsurface sediments, and bulk sediments) are presented in the following subsections. The specific analytical methods (e.g., EPA Method 8082A) are presented in Tables 5-1 through 5-4. Required sample containers and handling requirements are presented in Table 4-2.

5.1. Surface Sediment Samples

The comprehensive analytical list for surface sediments is presented in Table 5-1. With the exception of the physical parameters (total solids, TOC, and grain size) which will be analyzed for samples collected in each area, requirements for chemical analysis of Driver COCs will vary in the different areas. The following subsections describe the variable analytical requirements by area. Each accepted subsample will be archived at the laboratory separately, as well as a split sample of the composited sample.

5.1.1. Areas 1 and 4

Samples from Areas 1 and 4 will be analyzed for the following Driver COCs:

- PCB Aroclors
- PCDD/Fs

5.1.2. Areas 2 and 3

Samples from Areas 2 and 3 will be analyzed for PCB Aroclors.

5.1.3. Area 5

Samples from Area 5 (the former Stan Herman warehouse) will be analyzed for PCDD/Fs.

5.2. Subsurface Sediment Samples

The comprehensive analytical list for subsurface sediments in Areas 1-4 is presented in Table 5-2. With the exception of the physical parameters (total solids, TOC, and grain size) which will be analyzed for samples collected in each area, requirements for chemical analysis will vary in the different areas. The following subsections describe the variable analytical requirements by area.

5.2.1. Areas 1 through 4

For subsurface sediment cores in Areas 1 through 4, a tiered laboratory analytical program (shown in Table 5-3) will be implemented at each core location to determine the DOC and document subsurface sediment conditions. The DOC is defined by Driver COC concentrations exceeding applicable RALs and PTW thresholds. At the Site, the DOC will be determined using PCB Aroclors as a screening parameter and confirmed by analyzing for PCDD/Fs in the interval below the PCB screening sample. Each sample analyzed under this approach will also

be analyzed for TOC, total solids, and grain size. An example of this tiered approach is illustrated in Figure 5-1. The tiered approach will consist of the following at each core location:

- **Tier 1: Determine DOC –** Two 1-ft interval samples (an "upper" and a "deeper") will be submitted to the laboratory for PCB Aroclors as an initial bounding step. Additionally, for the Vibracore sediment cores only, the deepest interval in the core (at the bottom) will be submitted for analysis of PCB Aroclors during Tier 1 to confirm the total core depth is sufficient to determine the DOC. If the deepest interval in the Vibracore sample exceeds the applicable RT, the station will be identified for deeper coring using sonic drilling.

  Remaining intervals will be archived at the laboratory for potential additional analysis. The determination of initial Tier 1 sample depths will be based on both the historical and ongoing Phase I RD sample results from earlier cores. The selection of Tier 1 sample intervals will be finalized by the field team during core logging. Table 4-3 provides the estimated total PCB DOC based on historical data, for reference.

  The upper 1-ft interval will be between the mudline and 5 ft. The objective of collecting the upper interval is to confirm the presence of shallow subsurface contamination in excess of the total PCB RAL. If the upper interval result is below the total PCB RAL, an interval closer to the mudline (i.e., less deep) will be identified for total PCB analysis to identify the depth of the total PCB RAL exceedance.

  The deeper 1-ft interval sample will be taken between 5 and 25 ft below the mudline, depending on existing information and core depth. The objective of collecting the deeper interval is to identify the depth of sediments that exceeds the total PCB RAL at each core location. It is anticipated that multiple deep interval samples will be required to meet this objective. For example, if the initial deep sample exceeds the total PCB RAL, a deeper interval will be analyzed to achieve this objective. Alternatively, if the initial deep sample result is lower than the RAL, an interval above the initial deep sample will be analyzed to achieve this objective. The results from these initial intervals will guide any additional interval(s) to be analyzed during Tier 1 to establish the DOC.
- **Tier 2: Confirm DOC –** After establishing the interval at which total PCB concentration in the Tier 1 sample is less than RTs, the archived 1-ft sediment sample immediately below that interval will be analyzed for PCB Aroclors and PCDD/Fs (see Table 5-2). This analysis will determine whether all Tier 2 analytes are below the applicable Driver COC RTs. If detections exceed the RTs in the initial Tier 2 sample, then samples from other intervals will be analyzed until the DOC has been confirmed by two consecutive 30-cm intervals below RTs. Once the DOC has been determined, a Tier 3 analysis will be conducted for 10 selected locations.
- **Tier 3: Document Leave Surface –** The interval immediately below the DOC sample is considered to be representative of the post-dredging leave surface. The leave surface interval will analyzed for all COCs listed in ROD Table 17 (see Table 5-2) at 10 subsurface locations (approximately one location/acre), evenly spaced across the SMAs in the Site (Areas 1-4) to document conditions that will remain following remediation. See Section 3.3 for details.

In addition to the analytes described above, in cores where fine-grained material is encountered, Atterberg Limits will be analyzed for geotechnical properties. These locations will be determined in the field, depending on site conditions. It is expected that 10 to 15 samples will be analyzed for Atterberg Limits.

5.2.2. Area 6

Because of the predominance of coarse grained material, the sample preparation has been modified to include air drying, sieving, and analysis of the fine fraction of sediments as described below.

1. Advance five sediment cores to 5 ft below mudline.
2. The 5-ft cores will be sectioned into 1-ft intervals. The upper 1- and 2-ft intervals at each core location will be submitted to the laboratory for processing and analysis. The remaining intervals will be archived.
3. Because of the predominance of cobbles and gravel, all samples targeted for analysis will be air dried and sieved prior to analysis. The total mass of the sample and mass of each grain size retained on the sieve screens will be recorded.
4. The fine-grained fraction of sample (grain size < 2 millimeters [mm]) will be analyzed for PCB Aroclors, TOC, total solids, and grain size. The laboratory will prepare representative samples for analyses consistent with Interstate Technology & Regulatory Council guidelines (ITRC, 2020) and Apex SOP-G 105 RSM. Comminution of < 2 mm fraction to less than 60-micron particles will be completed prior to analyses of PCB Aroclors, TOC, and total solids. The processing is necessary to create a representative mixture of particles, all of equal size and shape.
5. The results from the grain size analysis of the bulk sample will be used to calculate the percentage of the total sample mass made up of the fine-grained fraction of the sample (<2 mm). Material >2mm is assumed to be not contaminated for the purposes of this Area 6 study. This information allows an estimation of the bulk sediment PCB concentration by multiplying the analytical result of the fine fraction times the percentage of the fine material of the total sample mass.

The laboratory sample preparation methodology for this approach is described in Section 4.3 of the QAPP (Appendix B).

5.3. Bulk Sediment Samples

Bulk sediment samples will be analyzed for design and implementation-specific properties as described in Table 5-3. Bulk sediment testing procedures are described in QAPP Section 3 (Appendix B).

A preliminary screening of the RM11E analytical data was performed and described in the BODR (Section 6.2.8; DOF and GSI, 2019), wherein RM11E sediment concentrations are compared to Table 1 in 40 CFR 261.24 (TCLP criteria) for each constituent and the corresponding hazardous constituent concentration threshold limit. Only two metals, chromium and lead, indicated a potential to exceed Resource Conservation and Recovery Act

(RCRA) toxicity characteristic regulatory levels. Consequently, those two metals were selected for TCLP testing as part of the bulk sediment program.

5.4. DRET and Bulk Water Samples

DRET will be performed as described in QAPP Section 3.2 (Appendix B). A single bulk water sample, as well as the elutriate from the DRET analysis, will be analyzed for the ROD Table 17 Surface Water COCs as described in Table 5-4.

5.5. QA/QC Procedures

Laboratory QA/QC will be maintained through the use of standard EPA and other accepted methods and standard analytical procedures for the target analytes. Analytical methods and QC measurements and criteria will be based on current EPA Superfund Contract Laboratory Program and SW-846 requirements and relevant EPA guidance. Laboratory methods, QA procedures, and QA/QC requirements for the sampling as well as data validation procedures are included in the QAPP Sections 4 and 5 (Appendix B).

Table 4-2 details the sample containers, preservation, and holding times. Field QC samples are described in Table 5-5. Method reporting and laboratory detection and control limits by analyte are included in Tables 4-1 through 4-3 of the QAPP (Appendix B).

6. Data Management

Data management protocols for both field data and electronic data will be implemented to provide consistent, accurate, and defensible documentation of data quality. These protocols are described in the DQMP (Appendix C).

6.1. Field Data Management

Field activities and observations will be documented on field forms and in logbooks during implementation of the sampling activities. Sample description forms will be completed for all samples. Chain-of-custody forms, which document sample possession and handling from the time of collection through relinquishment to the primary contract laboratory, will be maintained as part of the field records. Examples of field data sheets and forms are provided in Attachment 3.

The field records will be kept in the project file as a permanent record of the sampling or field measurement activities. All field records will be copied, scanned, and/or entered into an electronic spreadsheet to create an electronic record for the project file. QA reviews by the PM or SAC will check for consistency between the electronic and hard copies and identify anomalous values or erroneous entries.

6.2. Electronic Data Management

The electronic field data will be incorporated into the project database by the DM. Management of electronic data files is described in the DQMP (Appendix C).

7. Reporting

The data from the sampling described in this SAP will be included in the RM11E Phase I RD Sampling and Data Report. This report will document field activities and analytical results from each task and describe any deviations from the associated SAP procedures. The report will be submitted to EPA within 90 days of receipt of the final validated analytical data package.

8. References

AECOM and Geosyntec. 2019. PDI Evaluation Report, Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling, Portland Harbor Superfund Site, Portland, Oregon. Prepared for U.S. Environmental Protection Agency on behalf of Portland Harbor Pre-RD AOC Group. Prepared by AECOM and Geosyntec Consultants.

DEA. 1999. State to Level 3 Communications, Exhibit A. Prepared by David Evans and Associates, Inc.

DOF and GSI. 2019. Basis of Design Report, River Mile 11 East. Prepared for RM11E Group. Prepared by Dalton, Olmsted & Fuglevand, Inc., and GSI Water Solutions, Inc. October 2019.

DOF. 2015. Draft Implementability Study Report Supplemental Remedial Investigation/ Feasibility Study. Prepared by Dalton, Olmsted & Fuglevand, Inc., with David Evans and Associates, Inc.; KPFF Consulting Engineers; and Geotechnical Resources, Inc.

EPA. 2017. Portland Harbor Superfund Site Record of Decision. Portland, Oregon.

EPA. 2019. Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon. U.S. Environmental Protection Agency, Region 10, Seattle. December 2019.

EPA. 2020. Remedial Design Guidelines and Considerations, Portland Harbor Superfund Site, Portland Oregon. Seattle, Washington. February 28, 2020.

GRI and DOF. 2020. Phase I Remedial Design Geotechnical Sampling and Analysis Plan and Response to EPA Comments. Prepared by GRI and Dalton, Olmsted & Fuglevand, Inc. on behalf of the River Mile 11 East Group.

GSI and DOF. 2013. Final Supplemental Remedial Investigation/Feasibility Study Work Plan. Prepared for RM11E Group. GSI Water Solutions, Inc., and Dalton, Olmsted, & Fuglevand, Inc. October 2013. March 25, 2020.

GSI and DOF. 2018. Final Recontamination Assessment Report River Mile 11 East. Prepared by GSI Water Solutions, Inc., and Dalton, Olmsted, & Fuglevand, Inc. November 2018.

GSI. 2009a. Sampling and Analysis Plan, River Mile 11 East Focused Sediment Characterization. Prepared for the Oregon Department of Environmental Quality. Prepared by GSI Water Solutions, Inc. May 1, 2009.

GSI. 2009b. Draft Surface and Subsurface Field and Data Report, River Mile 11 East Focused Sediment Characterization. Prepared for the Oregon Department of Environmental Quality. Prepared by GSI Water Solutions, Inc. August 2009.

GSI. 2009c. Field and Data Report, Downtown Portland Sediment Characterization, Willamette River, Oregon. Prepared for the Oregon Department of Environmental Quality. GSI Water Solutions, Inc., January 2009.

GSI. 2010a. Draft In-River Sediment Trap Field and Data Report, River Mile 11 East Focused Sediment Characterization. Prepared for City of Portland, Bureau of Environmental Services. Prepared by GSI Water Solutions, Inc. June 2010.

GSI. 2010b. Draft Bank Soil and Debris Field and Data Report. River Mile 11 East Focused Sediment Characterization. Prepared for City of Portland, Bureau of Environmental Services. Prepared by GSI Water Solutions, Inc. June 2010.

GSI. 2013. River Mile 11 East Supplemental Data Report: Archived Bank Soil and Sediment Re-Analysis. Prepared for City of Portland, Bureau of Environmental Services. Prepared by GSI Water Solutions, Inc. April 2013.

GSI. 2014. Final Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland, Oregon. Prepared for RM11E Group. GSI Water Solutions, Inc. September 2014.

ITRC. 2020. Clarifications to ITRC 2012 ISM-1 Guidance, January 22, 2020. Prepared by the Interstate Technology & Regulatory Council Team Leaders and Program Advisor of the ISM-2 Update Team.

Northwest Regional Sediment Evaluation Team. 2018 Sediment Evaluation Framework for the Pacific Northwest. Prepared by the Northwest Regional Sediment Evaluation Team (RSET) Agencies: U. S. Army Corps of Engineers, U.S. Environmental Protection Agency, NOAA Fisheries, U.S. Fish and Wildlife Service, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, Washington Department of Ecology, Washington Department of Natural Resources. May 2018.

PSEP. 1997a. Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound. Puget Sound Estuary Program. U.S. Environmental Protection Agency, Region 10, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA.

RM 11E Group. 2018. River Mile 11E Project Area, Comments on the Final Trip Report for the Willamette Sediment Sampling Site, Stan Herman Warehouse Facility. Prepared for the River Mile 11 East Group by GSI Water Solutions, Inc., and Dalton, Olmsted, & Fuglevand, Inc. August 2018.

USACE. 2014. Portland District Hydro Survey 2014, WR_2014_Channel.DXF. Prepared by the U. S. Army Corps of Engineers.

USGS. 2013. National Water Information System Web Interface – Water data for Oregon, U.S. Geological Survey (USGS) data available on the Web, accessed in 2013, at http://waterdata.usgs.gov/or/nwis/nwis.

This page intentionally left blank.

Tables

Page intentionally left blank.

Table 3-1
Sampling Locations Within Each Sample Area

Sample Area	Station ID	
	Sediment Cores	***Sediment Grabs***
Area 1	C050 to C073	G100 to G107
Area 2	C074 to C081	G108 to G110
Area 3	C082 to C099	G111 to G116
Area 4	C100 to C108	G117
Area 5	NA	G118 to G122[1]
Area 6	C109 to C113	NA

Notes

[1] Two samples from Area 5 (G118 and G119) are above +13 NAVD 88. These are grouped with other Area 5 samples as surface sediment grabs for organizational purposes only.

NA = not applicable
NAVD 88 = North American Vertical Datum of 1988

Page intentionally left blank.

Table 3-2
Rationale for Proposed Soil and Sediment Sampling Locations

Sampling Area	Sample Objectives	Number of Stations		Target Sampling Depth	Core Sampling Intervals	Rationale
		Grab Samples	Core Samples			
1 - Cargill	SMA Refinement Dredge Prism	8	24	Surface sediment: 30 cm Sediment cores: up to 14 ft	1-ft continuous intervals across full core depth	Data defining SMA footprint is dated. DOC not fully defined.
2 - Cable Crossing	SMA Refinement Dredge Prism	3	8	Surface sediment: 30 cm Sediment cores: up to 25 ft	1-ft continuous intervals across full core depth	Data defining SMA footprint is dated. DOC not fully defined.
3 - Glacier	SMA Refinement Dredge Prism	6	18	Surface sediment: 30 cm Sediment cores: up to 15 ft	1-ft continuous intervals across full core depth	Data defining SMA footprint is dated. DOC not fully defined.
4 - Ross Island Sand & Gravel	SMA Refinement Dredge Prism	1	9	Surface sediment: 30 cm Sediment cores: up to 15 ft	1-ft continuous intervals across full core depth	Data defining SMA footprint is dated. DOC not fully defined.
5 - Stan Herman Warehouse	Characterization	5	0	30 cm	NA	Assess presence of D/Fs resulting from 2017 warehouse fire.
6 - Downriver SMA	CSM Verification	0	5	up to 5 ft	1-ft continuous intervals across full core depth; analyze top two intervals	Refine CSM by evaluating thickness and lateral distribution of soft sediment overlyinig native gravel substrate.
	TOTALS	**23**	**64**			

Notes
[1] Physical analyses (grain size, TOC, total solids) will be run on all samples submitted for analysis.
[2] For sediment cores, selected 1-ft intervals will be analyzed to determine the DOC. All remaining intervals will be archived for analysis if required.

Cargill = Cargill, Inc.
cm = centimeter
CSM = conceptual site model
DOC = depth of contamination
ft = foot or feet
Glacier = Glacier Northwest, Inc.
NA = not applicable
RD = Remedial Design
SMA = sediment management area
TOC = total organic carbon

Page intentionally left blank.

Table 3-3
Bulk Sediment Sampling IDs

Bulk Sample Area	Sediment Core ID	Sample Depth (ft)	Bulk Sample ID	Bulk Composite ID
A1	C055	0-3	A1-1-0-3	RM11E-A1C
	C058	0-3	A1-2-0-3	
	C062	0-3	A1-3-0-3	
	C067	0-3	A1-4-0-3	
	C073	0-3	A1-5-0-3	
A2	C076	0-10	A2-1-0-10	RM11E-A2C
	C079	0-10	A2-2-0-10	
	C086	0-3	A2-3-0-3	
	C088	0-3	A2-4-0-3	
	C095	0-3	A2-5-0-3	
A3	C098	0-5	A3-1-0-5	RM11E-A3C
	C101	0-3	A3-2-0-3	
	C103	0-3	A3-3-0-3	
	C106	0-3	A3-4-0-3	
	C107	0-3	A3-5-0-3	

Note
ft = foot or feet

Table 4-1
Proposed Sampling Locations

Station ID	Bulk Sediment Sample[1]	Sample Area	Target Location[2]		Sequential Station Count
			Easting	Northing	
Surface Sediments					
RM11E-G100	-	Area 1	7644983.80	688377.90	1
RM11E-G101	-		7644942.30	688478.24	2
RM11E-G102	-		7644886.59	688444.53	3
RM11E-G103	-		7644890.81	688570.51	4
RM11E-G104	-		7644829.08	688533.16	5
RM11E-G105	-		7644670.83	688725.45	6
RM11E-G106	-		7644569.28	688827.81	7
RM11E-G107	-		7644506.46	688952.82	8
RM11E-G108	-	Area 2	7644213.87	689100.24	9
RM11E-G109	-		7644156.77	689044.15	10
RM11E-G110	-		7644253.00	689226.00	11
RM11E-G111	-	Area 3	7644119.79	689151.62	12
RM11E-G112	-		7643999.44	689147.07	13
RM11E-G113	-		7644033.75	689212.31	14
RM11E-G114	-		7643976.85	689302.83	15
RM11E-G115	-		7643825.78	689291.62	16
RM11E-G116	-		7643698.15	689467.84	17
RM11E-G117	-	Area 4	7643578.21	689653.15	18
RM11E-G118	-	Area 5	7643105.01	690503.27	19
RM11E-G119	-		7643058.30	690463.31	20
RM11E-G120	-		7642999.66	690413.67	21
RM11E-G121	-		7642922.68	690346.02	22
RM11E-G122	-		7642878.66	690304.46	23

Continued on next page.

Table 4-1
Proposed Sampling Locations

Station ID	Bulk Sediment Sample[1]	Sample Area	Target Location[2]		Sequential Station Count
			Easting	Northing	
Subsurface Sediments					
RM11E-C050	-	Area 1	7644957.25	688424.58	1
RM11E-C051	-		7644929.45	688407.56	2
RM11E-C052	-		7644894.55	688386.54	3
RM11E-C053	-		7644889.05	688569.58	4
RM11E-C054	-		7644875.29	688561.01	5
RM11E-C055	X		7644856.97	688549.73	6
RM11E-C056	-		7644829.08	688533.16	7
RM11E-C057	-		7644828.74	688717.72	8
RM11E-C058	X		7644811.86	688707.88	9
RM11E-C059	-		7644793.53	688696.39	10
RM11E-C060	-		7644772.24	688683.83	11
RM11E-C061	-		7644735.12	688661.44	12
RM11E-C062	X		7644746.86	688854.41	13
RM11E-C063	-		7644717.47	688835.90	14
RM11E-C064	-		7644688.77	688819.07	15
RM11E-C065	-		7644663.45	688803.22	16
RM11E-C066	-		7644661.42	688987.13	17
RM11E-C067	X		7644630.95	688968.70	18
RM11E-C068	-		7644605.99	688953.59	19
RM11E-C069	-		7644582.52	688939.72	20
RM11E-C070	-		7644568.56	689120.30	21
RM11E-C071	-		7644546.20	689092.22	22
RM11E-C072	-		7644529.50	689071.24	23
RM11E-C073	X		7644480.09	689009.20	24
RM11E-C074	-	Area 2	7644431.32	689245.64	25
RM11E-C075	-		7644415.32	689213.38	26
RM11E-C076	X		7644396.75	689169.40	27
RM11E-C077	-		7644355.26	689080.08	28
RM11E-C078	-		7644315.16	689300.06	29
RM11E-C079	X		7644287.19	689244.16	30
RM11E-C080	-		7644255.65	689170.56	31
RM11E-C081	-		7644241.47	689126.00	32
RM11E-C082	-	Area 3	7644225.18	689367.79	33
RM11E-C083	-		7644207.86	689346.98	34
RM11E-C084	-		7644189.43	689323.83	35
RM11E-C085	-		7644167.91	689296.18	36
RM11E-C086	X		7644137.66	689258.77	37
RM11E-C087	-		7644095.30	689458.86	38
RM11E-C088	X		7644081.18	689441.39	39
RM11E-C089	-		7644064.44	689420.37	40
RM11E-C090	-		7644049.00	689400.84	41
RM11E-C091	-		7644022.15	689367.27	42
RM11E-C092	-		7643975.90	689563.72	43
RM11E-C093	-		7643950.25	689532.03	44
RM11E-C094	-		7643928.57	689504.81	45
RM11E-C095	X		7643900.47	689469.52	46
RM11E-C096	-		7643845.31	689654.53	47
RM11E-C097	-		7643828.61	689633.56	48
RM11E-C098	X		7643808.87	689608.28	49
RM11E-C099	-		7643771.05	689561.28	50

Continued on next page.

Table 4-1
Proposed Sampling Locations

Station ID	Bulk Sediment Sample[1]	Sample Area	Target Location[2]		Sequential Station Count
			Easting	Northing	
RM11E-C100	-	Area 4	7643717.95	689747.31	51
RM11E-C101	X		7643706.24	689732.61	52
RM11E-C102	-		7643658.52	689672.05	53
RM11E-C103	X		7643626.97	689633.06	54
RM11E-C104	-		7643594.32	689848.55	55
RM11E-C105	-		7643575.38	689825.02	56
RM11E-C106	X		7643535.83	689775.48	57
RM11E-C107	X		7643442.06	689910.29	58
RM11E-C108	-		7643393.30	689848.75	59
RM11E-C109	-	Area 6	7642663.48	690354.57	60
RM11E-C110	-		7642718.07	690459.59	61
RM11E-C111	-		7642480.08	690480.99	62
RM11E-C112	-		7642542.72	690696.75	63
RM11E-C113	-		7642431.25	690654.94	64

Notes

[1] Core samples are co-located bulk testing cores.

[2] Horizontal Projection: NAD 1983 (2011) State Plane Coordinate System (SPCC) Oregon North Zone (International Feet).

NAD 1983 = North American Datum of 1983

Table 4-2
Sample Containers, Preservation, and Holding Times

Analyte	Container[1]		Preservation		Holding Time	
	Type	Size	Refrigerate	Deep Frozen	Refrigerate	Deep Frozen
PCB Aroclors	WMG	8 oz	≤ 6°C	-20°C	1 year	1 year
PCB Aroclors Rinse Waters	G	1 liter	≤ 6°C	-	7 days	-
PCDD/Fs	WMG	4 oz	≤ 6°C	-20°C	1 year	1 year
Pesticides	WMG	8 oz	≤ 6°C	-20°C	14 days	1 year
PAHs and BEHP[2]	WMG	8 oz	≤ 6°C	-20°C	14 days	1 year
Metals	G or P	8 oz	≤ 6°C	-20°C	6 months	2 years
Mercury	WMG	8 oz	≤ 6°C	-20°C	28 days	28 days
Tributyltin	WMG	4 oz	≤ 6°C	-20°C	14 days	1 year
Grain size	G or P	16 oz	4 ± 2°C	-	6 months	-
TOC	WMG	8 oz	≤ 6°C	-20°C	14 days	1 year
Total solids	G or P	8 oz	≤ 6°C	-20°C	14 days	6 months
DRET-Sediment	Z	1 gal	≤ 6°C	-	-	-
DRET-Water	G or P	64 oz	≤ 6°C	-	-	-
Treatability-Sediment	WMG	1 L	≤ 6°C	-	-	-
Treatability-Water	G or P	64 oz	≤ 6°C	-	-	-
Handling	P	5 gal	≤ 6°C	-	-	-

Notes

[1] Multiple tests can be taken from the same container. Subcontracted tests will be provided in containers specific to the subcontractor needs.

[2] Containers should be field-preserved 2- methanol vials using EPA 5035 extraction.

BaP eq = benzo(a)pyrene equivalents
BEHP = bis(2-ethylhexyl)phthalate
°C = degree Celsius
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
DRET = Dredging Elutriate Test
EPA = U.S. Environmental Protection Agency
G = glass
gal = gallon
L = liter
oz = ounce
PAHs = polycyclic aromatic hydrocarbons
P = plastic
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzodioxins/polychlorinated dibenzofurans
SVOCs = Semivolatile organic compounds
TOC = total organic carbon
VOCs = volatile organic compounds
WMG = wide-mouth glass
Z = Ziplock (1-gallon)

Page intentionally left blank.

Table 4-3
Subsurface Sediment Sample Methodology, Target Depth, and Anticipated Depth of Contamination

Station ID	Bulk Sediment Sample[1]	Sample Area	Target Location[2]		Sequential Station Count	Sampling Method	Target Core Depth (ft)	Closest Historical Core	Anticipated DOC (ft bml)[4]	Bounded DOC?
			Easting	Northing						
RM11E-C050	-	Area 1	7644957.25	688424.58	1	Vibracore	14	C041 and C039	0	Yes
RM11E-C051	-		7644929.45	688407.56	2	Vibracore	14	C041 and C039	0	Yes
RM11E-C052	-		7644894.55	688386.54	3	Vibracore	14	C041 and C039	0	Yes
RM11E-C053	-		7644889.05	688569.58	4	Vibracore	14	C038	0	No
RM11E-C054	-		7644875.29	688561.01	5	Vibracore	14	C038	0	No
RM11E-C055	X		7644856.97	688549.73	6	Vibracore	14	C038	0	No
RM11E-C056	-		7644829.08	688533.16	7	Vibracore	14	C038	0	No
RM11E-C057	-		7644828.74	688717.72	8	Vibracore	14	C035	0	No
RM11E-C058	X		7644811.86	688707.88	9	Vibracore	14	C035	0	No
RM11E-C059	-		7644793.53	688696.39	10	Vibracore	14	C035	0	No
RM11E-C060	-		7644772.24	688683.83	11	Vibracore	14	C035	0	Yes
RM11E-C061	-		7644735.12	688661.44	12	Vibracore	14	C036	0	Yes
RM11E-C062	X		7644746.86	688854.41	13	Vibracore	14	C032	1	Yes
RM11E-C063	-		7644717.47	688835.90	14	Vibracore	14	C032	1	Yes
RM11E-C064	-		7644688.77	688819.07	15	Vibracore	14	C032	1	Yes
RM11E-C065	-		7644663.45	688803.22	16	Vibracore	14	C033	0	Yes
RM11E-C066	-		7644661.42	688987.13	17	Vibracore	14	C029	0	No
RM11E-C067	X		7644630.95	688968.70	18	Vibracore	14	C029	0	No
RM11E-C068	-		7644605.99	688953.59	19	Vibracore	14	C029	0	No
RM11E-C069	-		7644582.52	688939.72	20	Vibracore	14	C029	0	No
RM11E-C070	-		7644568.56	689120.30	21	Vibracore	14	C047	5	Yes
RM11E-C071	-		7644546.20	689092.22	22	Vibracore	14	C047	5	Yes
RM11E-C072	-		7644529.50	689071.24	23	Vibracore	14	C047	5	Yes
RM11E-C073	X		7644480.09	689009.20	24	Vibracore	14	C026	1	Yes
RM11E-C074	-	Area 2	7644431.32	689245.64	25	Sonic	25	C022	>10	No
RM11E-C075	-		7644415.32	689213.38	26	Sonic	25	C022	>10	No
RM11E-C076	X		7644396.75	689169.40	27	Sonic	25	C023	1	Yes
RM11E-C077	-		7644355.26	689080.08	28	Sonic	25	C023	1	Yes
RM11E-C078	-		7644315.16	689300.06	29	Sonic	25	C022	>10	No
RM11E-C079	X		7644287.19	689244.16	30	Sonic	25	C022	>10	No
RM11E-C080	-		7644255.65	689170.56	31	Sonic	25	C023	1	Yes
RM11E-C081	-		7644241.47	689126.00	32	Sonic	25	C023	1	Yes
RM11E-C082	-	Area 3	7644225.18	689367.79	33	Vibracore	14	C019	3	Yes
RM11E-C083	-		7644207.86	689346.98	34	Vibracore	14	C019	3	Yes
RM11E-C084	-		7644189.43	689323.83	35	Vibracore	14	C019	3	Yes
RM11E-C085	-		7644167.91	689296.18	36	Vibracore	14	C019	3	Yes
RM11E-C086	X		7644137.66	689258.77	37	Vibracore	14	C020	0	Yes
RM11E-C087	-		7644095.30	689458.86	38	Vibracore	14	C048	0	No
RM11E-C088	X		7644081.18	689441.39	39	Vibracore	14	C048	1	No
RM11E-C089	-		7644064.44	689420.37	40	Vibracore	14	C048	1	No
RM11E-C090	-		7644049.00	689400.84	41	Vibracore	14	C048	3	No
RM11E-C091	-		7644022.15	689367.27	42	Vibracore	14	C048	3	No
RM11E-C092	-		7643975.90	689563.72	43	Sonic	15	C015	1	Yes
RM11E-C093	-		7643950.25	689532.03	44	Vibracore	14	C015	1	Yes
RM11E-C094	-		7643928.57	689504.81	45	Vibracore	14	C015	1	Yes
RM11E-C095	X		7643900.47	689469.52	46	Vibracore	14	C016	0	Yes
RM11E-C096	-		7643845.31	689654.53	47	Vibracore	14	C012	0	Yes
RM11E-C097	-		7643828.61	689633.56	48	Vibracore	14	C012	3	Yes
RM11E-C098	X		7643808.87	689608.28	49	Vibracore	14	C012	3	Yes
RM11E-C099	-		7643771.05	689561.28	50	Vibracore	14	C013	0	Yes

Continued on next page.

Table 4-3
Subsurface Sediment Sample Methodology, Target Depth, and Anticipated Depth of Contamination

Station ID	Bulk Sediment Sample[1]	Sample Area	Target Location[2]		Sequential Station Count	Sampling Method	Target Core Depth (ft)	Closest Historical Core	Anticipated DOC (ft bml)[4]	Bounded DOC?
			Easting	Northing						
RM11E-C100	-	Area 4	7643717.95	689747.31	51	Sonic	15	C010	0	Yes
RM11E-C101	X		7643706.24	689732.61	52	Sonic	15	C010	3	Yes
RM11E-C102	-		7643658.52	689672.05	53	Sonic	15	C010	1	Yes
RM11E-C103	X		7643626.97	689633.06	54	Sonic	15	C010	1	Yes
RM11E-C104	-		7643594.32	689848.55	55	Sonic	15	C006	0	Yes
RM11E-C105	-		7643575.38	689825.02	56	Sonic	15	C006	0	Yes
RM11E-C106	X		7643535.83	689775.48	57	Vibracore	14	C007	1	Yes
RM11E-C107	X		7643442.06	689910.29	58	Vibracore	14	C003	>6	No
RM11E-C108	-		7643393.30	689848.75	59	Vibracore	14	C004	1	Yes
RM11E-C109	-	Area 6	7642663.48	690354.57	60	Sonic	5	-	Unknown	No
RM11E-C110	-		7642718.07	690459.59	61	Sonc	5	-	Unknown	No
RM11E-C111	-		7642480.08	690480.99	62	Sonic	5	-	Unknown	No
RM11E-C112	-		7642542.72	690696.75	63	Sonic	5	-	Unknown	No
RM11E-C113	-		7642431.25	690654.94	64	Sonic	5	-	Unknown	No

Notes
[1] Core samples are co-located bulk testing cores.
[2] Horizontal Projection: NAD 83 (2011) State Plane Coordinate System (SPCC) Oregon North Zone (International Feet).
[3] Some sample locations may require a smaller vessel for access (under or behind docks, etc.). Cores in these areas may be shorter in length.
[4] DOC is based on historical total PCB results.

DOC = depth of contamination
ft = feet
ft bml = feet below mudline
NAD 83 = North American Datum of 1983
PCB = polychlorinated biphenyl

Table 5-1
Surface Sediment Sample Analytes

Sample Area	Parameter	Analytical Method
1 and 4	PCB Aroclors	8082A
	PCDD/Fs	1613B
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD[2]
	Grain Size	D422mod[3]
2[1] and 3	PCB Aroclors	8082A
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD1
	Grain Size	D422mod[3]
5	PCDD/Fs	1613B
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD[2]
	Grain Size	D422mod[3]

Notes

[1] One sample (G110) will also be analyzed for DDx (EPA Method 1699M) as per Section 3 of the SAP.

[2] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) for high-temperature combustion followed by nondispersive infrared detection.

[3] In order to maintain comparability with all previous grain size data reported D422mod will continued to be used despite being considered a withdrawn method. The modifications are the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no.10 sieve).

µm = micrometer
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
mm = millimeter
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PSEP = Puget Sound Estuary Protocols
SAP = Sampling and Analysis Plan
TOC = total organic carbon

Table 5-2

Subsurface Sediment Sample Tiered Analytical Program for Areas 1 through 4

Sample Tier and Description	Analyte Group	Parameter	Analytical Method
All Samples: Tiers 1, 2, 3	Physical Parameters	Atterberg Limits[1]	ASTM D4318
		Total Solids	SM 2540 G
		TOC	SM 5310 B MOD[2]
		Grain Size	D422mod[3]
Tier 1: Determine DOC by PCBs	PCB Aroclors	PCB Aroclors	8082A
Tier 2: Confirm DOC	Tier 1 + PCDD/Fs	PCDD/Fs	1613B
Tier 3: Document Leave Surface by ROD Table 17 COCs	Tier 2 + remaining ROD Table 17 COCs	Aldrin	1699M
		Arsenic	6020A
		BEHP	8270D
		Cadmium	6020A
		Chlordanes[4]	1699M
		Copper	6020A
		4,4'- and 2,4'-DDD	1699M
		4,4'- and 2,4'-DDE	1699M
		4,4'- and 2,4'-DDT	1699M
		Dieldrin	1699M
		Lindane	1699M
		Lead	6020A
		Mercury	6020A
		PAHs	8270D
		cPAHs (BaP eq)	8270D
		TPH-Diesel	NWTPH-Dx
		Tributyltin	Krone
		Zinc	6020A

Notes

[1] Atterberg Limit tests will be conducted on 10–15 representative fine-grained samples, to be determined in the field.

[2] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) nfor high-temperature combustion followed by nondispersive infrared detection.

[3] In order to maintain comparability with all previous grain size data reported D422mod will continued to be used despite being considered a withdrawn method. The modifications are the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no. 10 sieve).

[4] Total chlordanes include the following analytes: cis-chlordane, trans-chlordane, trans-nonachlor, cis-nonachlor, oxychlordane.

µm = micrometer
BaP eq = benzo(a)pyrene equivalents
BEHP = bis(2-ethylhexyl)phthalate
COCs = contaminants of concern
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
mm = millimeter
PAHs = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PSEP = Puget Sound Estuary Protocols
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)
TOC = total organic carbon
TPH = total petroleum hydrocarbons

Table 5-3
Bulk Sediment Sample Analytes

Analyte Group	Parameter	Analytical Method
Physical Parameters	TOC	ASTM D4129-05
	Grain size	ASTM D422
TCLP	Lead	EPA 1311/6020A
	Chromium	
Jar tests (treatability and water clarification testing)	TSS	SM2540-D
	TDS	SM2540-C
	TOC	SM5310-C
	Cations[1]	6010C
	Anions[2]	300.0; SM4500 S2-D
	Hardness	6010C-calc
	pH	SM4500 H+B
Bench testing	Paint filter testing	EPA SW-846 Test Method 9095B
	Slump testing	NA
	Admixture testing	NA

Notes
[1] Calcium (Ca), magnesium (Mg), potassium (K), sodium (Na)
[2] Chlorine (Cl), sulfate (SO_4), nitrite (NO_{2-}), nitrate (NO_3), phosphate (PO_4)

NA = not applicable
PCB = polychlorinated biphenyl
TCLP = toxicity characteristic leaching procedure
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids

Table 5-4
DRET Bulk Water Sample Analytes

Analyte Group	Parameter	Analytical Method
ROD Table 17 - Surface Water COCs	Aldrin	8081B
	Arsenic	6020A
	BEHP	8270D
	Chlordanes	8081B
	Chromium	6020A
	Copper	6020A
	DDx	8081B
	4,4'- and 2,4'-DDD	8081B
	4,4'- and 2,4'-DDE	8081B
	4,4'- and 2,4'-DDT	8081B
	Ethylbenzene	8260
	Hexachlorobenzene	8081B
	MCPP	8151A
	Pentachlorophenol	8270D
	PCB Aroclors	8082A
	cPAHs (BaP eq)	8270D
	Benzo(a)anthracene	8270D
	Benzo(a)pyrene	8270D
	Benzo(b)fluoranthene	8270D
	Benzo(k)fluoranthene	8270D
	Chrysene	8270D
	Dibenz(a,h)anthracene	8270D
	Indeno(1,2,3-c,d)pyrene	8270D
	Naphthalene	8270D
	Dioxins/Furans (2,3,7,8-TCDD eq)	8290
	Tributyltin	ALS-SOP
	Zinc	6020

Notes
BaP eq = benzo(a)pyrene equivalents
BEHP = bis(2-ethylhexyl)phthalate
COCs = contaminants of concern
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
DRET = Dredge Elutriate Test
MCPP = 2-(4-chloro-2-methylphenoxy)propanoic acid
PCB = polychlorinated biphenyl
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)
TCDD = tetrachlorodibenzo-p-dioxin

Table 5-5
Field Quality Control

QC Sample Type	Estimated Total Number of QC Samples[1]	
	Surface Sediments	Subsurface Sediments[2]
Split Samples	2	14
Field Equipment Rinsate Blanks	1	2
Temperature Blanks	One per cooler	One per cooler

Notes

[1] Additional bottles (approximately 3x soil volume) will be needed for lab QC (e.g., MS/MSD) on chemical analyses, and duplicate volumes are required to support field split sampling to occur at approximate 5 percent frequency, or one sampling station out of 20.

[2] Additional split samples will be analyzed when Tier 1 archive samples and Tier 2 and 3 samples are analyzed.

MS = matrix spike
MSD = matrix spike duplicate
NA = not applicable
QC = quality control

Page intentionally left blank.

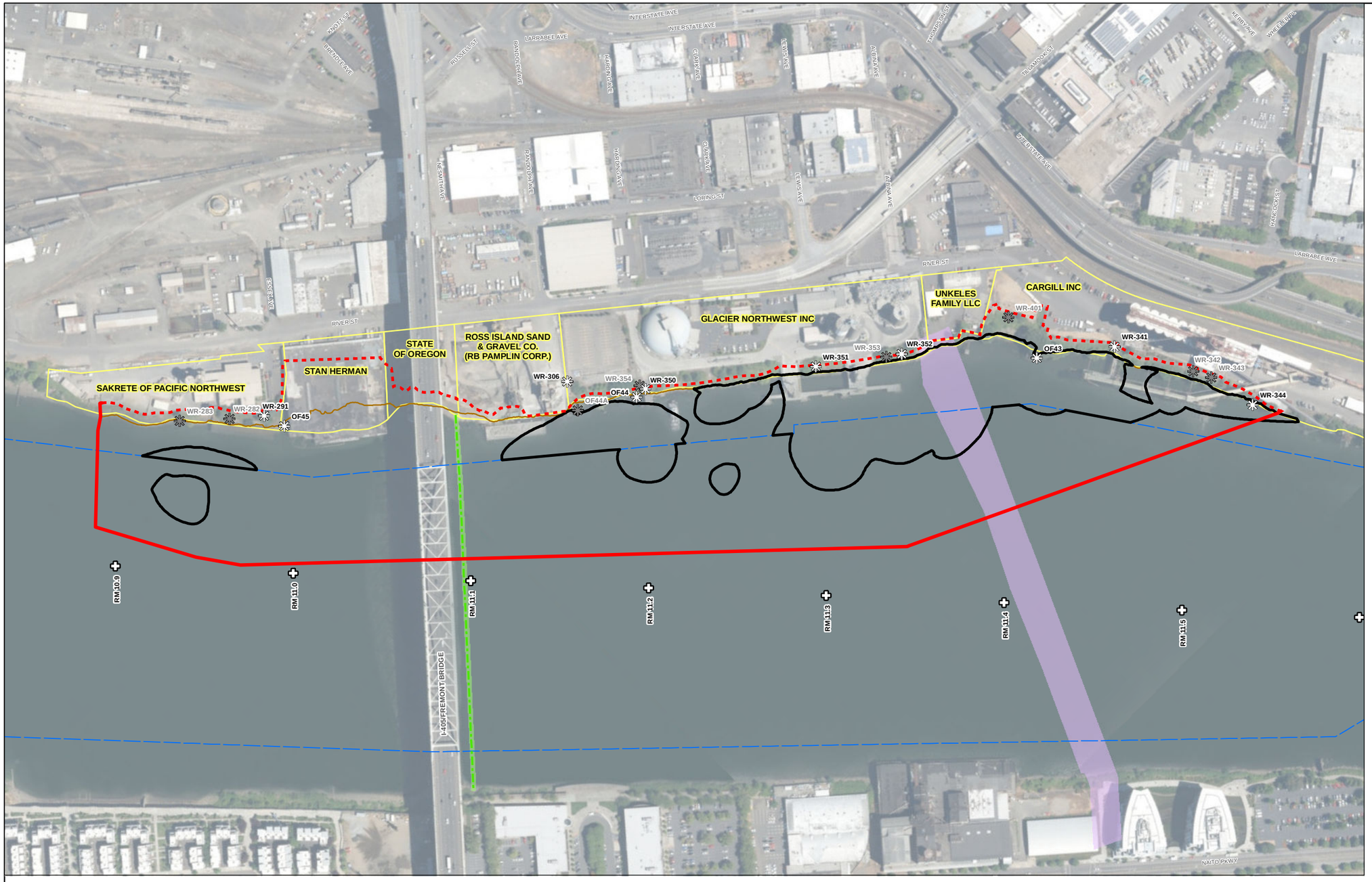
Figures

This page intentionally left blank.

FIGURE 1-1

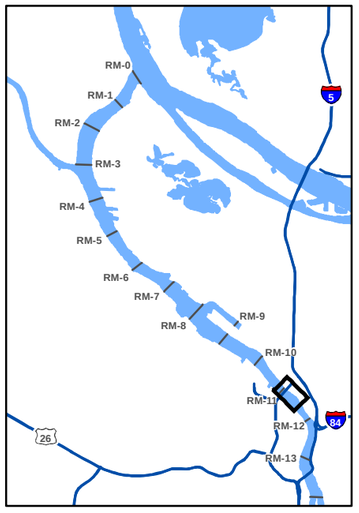
RM11E Project Area

River Mile 11 East
Willamette River
Portland, Oregon



LEGEND

- RM11E Project Area (dashed indicates inferred top of bank)[2]
- Riverbank Boundary (+13 ft NAVD88)
- Sediment Management Area[6]
- Shoreline Properties
- U.S. Army Corps of Engineers Navigation Channel
- Cable Crossing Caution Zone[4]
- Fiber Optic Cables[5]
- Fiber Optic Easement, 15ft[5]
- Active Outfall
- Inactive Outfall
- River Mile (RM) Tenth[3]



NOTES

NAVD88 = North American Vertical Datum of 1988

1. The locations of all features shown are approximate.
2. RM11E Project Area includes sediment below an elevation of +13 ft NAVD88 and the adjacent riverbank area to the top of bank.
3. The river mile (RM) designations are based on U.S. Army Corps of Engineers (USACE) stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
4. Modified from Figure 9.5 of the Implementability Study Report (DOF, 2015)
5. Digitized from Exhibit A of the State to Level 3 Communications (DEA, 1999)
6. The SMA footprints were delineated in the BODR using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

N

0 150 300 450
Feet

Date: March 5, 2020
Data Sources: USACE, METRO, Air Photo City of Portland (COP) 2015

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure1-1_RM11E_Project_Area.mxd

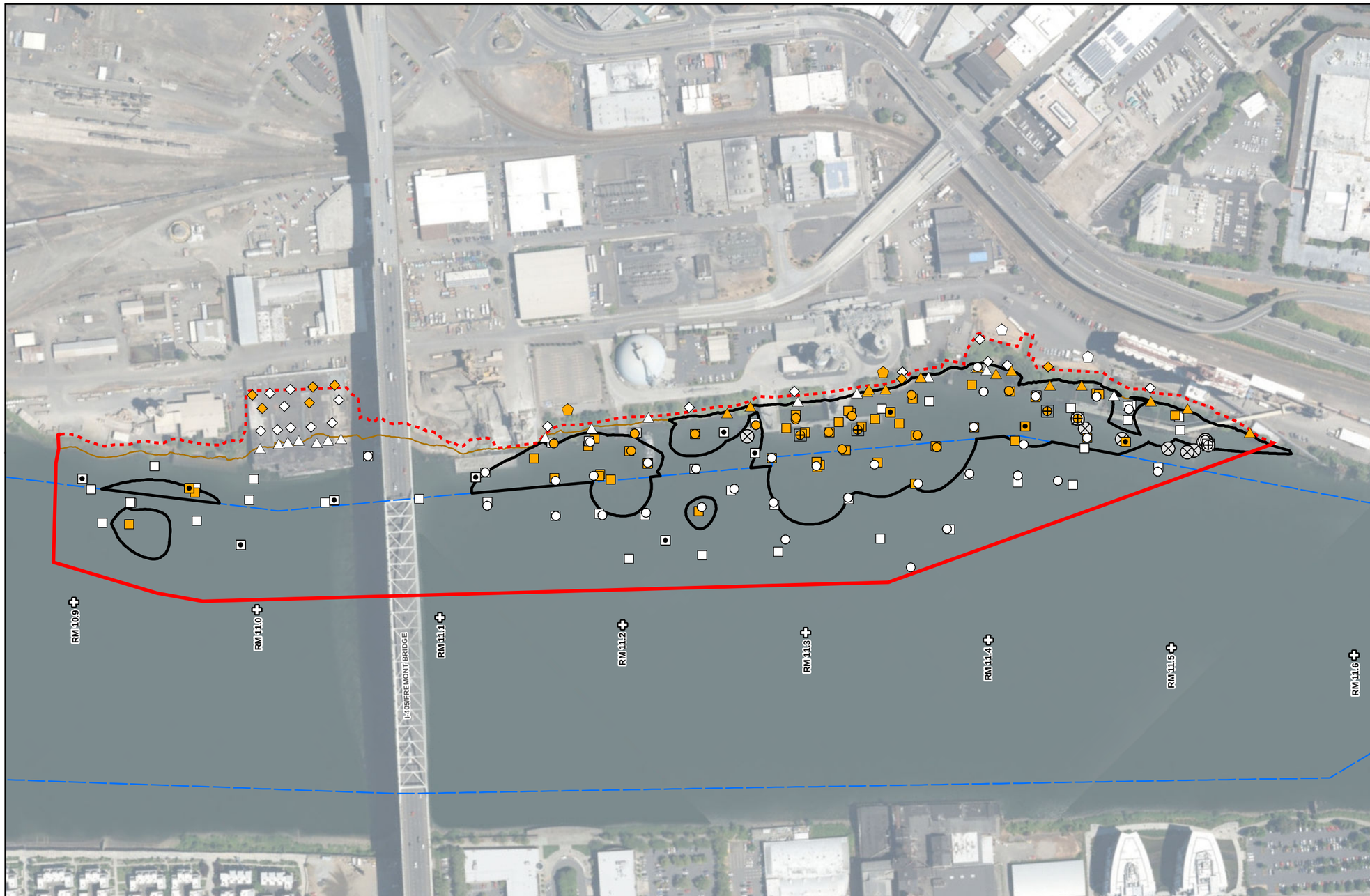


FIGURE 1-2

RM11E Historical Sediment and Soil Sample Locations

River Mile 11 East
Willamette River
Portland, Oregon

LEGEND

- Remediation Threshold Exceedance
- No Remediation Threshold Exceedance

Sediment and Soil Samples[6]

- Surface Soil[7]
- Subsurface Soil[7]
- Shoreline Surface Sediment
- Subsurface Sediment
- Surface Sediment
- Surface Sediment, Pre-RD
- Excluded Dredge Characterization Sample[4]
- Leave Surface Sample[5]

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area
- Riverbank Boundary (+13 ft NAVD88)
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths

NOTES:

NAVD88 = North American Vertical Datum of 1988
RT = Remediation Threshold
1. The locations of all features shown are approximate.
2. RM11E Project Area includes sediment below an elevation of +13 ft NAVD88 and the adjacent riverbank area to the top of bank.
3. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).
4. Samples representative of dredge material are not included in the BODR figures or DOI evaluation because the characterized material is anticipated to have been removed due to maintenance dredging.
5. These retained samples were obtained prior to maintenance dredging events that are considered to represent post-dredge surfaces (a.k.a. leave surface). While the "leave surface" characterization samples are included in this BODR and DOI evaluation out of conservatism, it is recognized that dredging activities may have affected contaminant concentrations (due to actual dredging depths achieved or residuals deposition) and applicability to current conditions is uncertain; therefore, these data may not represent the DOI in these sample areas and additional sampling will be required to refine the DOI during RD. As new sediment samples are collected during RD Sediment Characterization in the areas where these "leave surface" samples were collected, the new data will replace the "leave surface" data (see Section 2.7.3).
6. Figures only show samples within the RM11E Project Area.
7. RTs do not apply to top of bank or monitoring well soil samples or non-erosive riverbank. Comparison to RTs is provided for reference purposes only.

N

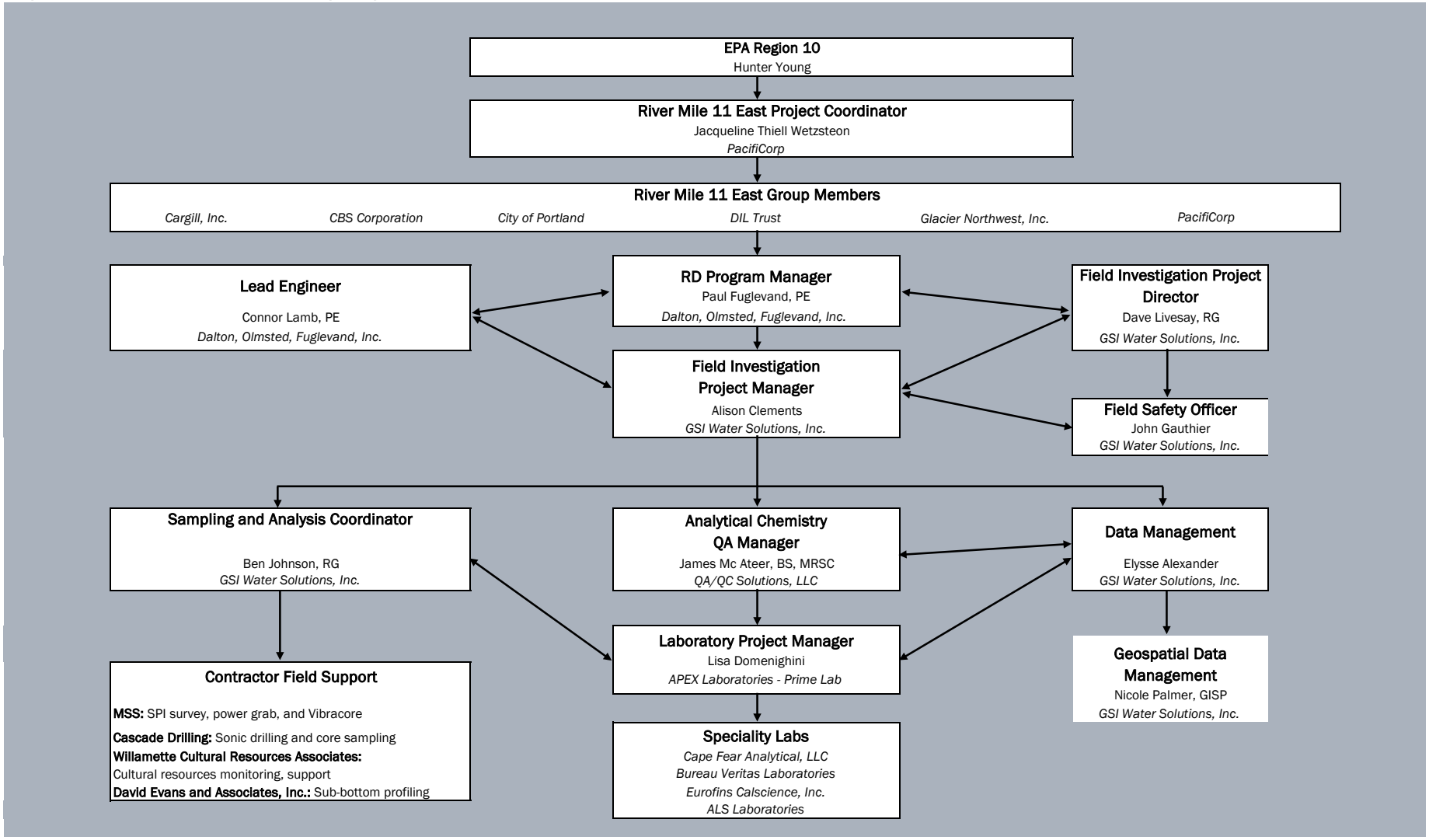
0 150 300 450
Feet

Date: March 6, 2020
Data Sources: BES, USACOE, METRO, Air Photo COP 2016

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\RDWP\Figure1-3a_Existing_Sample_Locations.mxd

Figure 2-1. Phase I RD Sampling Organizational Chart



LEGEND

- Proposed Surface Sediment Sampling Location
- Proposed Subsurface Sediment Sampling Location
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Riverbank Area
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Anchored Soldier Pile Retaining Wall
- Cantilevered Soldier Pile Wall
- Bulkhead Wall
- 5' Elevation Contour
- Building/Structure

NOTES

SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
2. "XXXXX–A" samples will be cores and "XXXXX–B" samples will be surface samples

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP
Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-1

Proposed Surface and Subsurface Sampling Stations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 120 240 360
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-1_Proposed_Sampling_Overview.mxd

LEGEND

- Proposed Surface Sediment Sampling Location
- Historical Surface Sediment Sample
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Total PCB RT Exceedance Area[2]
  Nearshore RT = 75 ug/kg
  Nav Channel RT = 200 ug/kg
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Anchored Soldier Pile Retaining Wall
- Cantilevered Soldier Pile Wall
- Bulkhead Wall
- 5 ft Elevation Contour
- Building/Structure

NOTES

ug/kg: Micrograms per kilogram
Nav Channel: Navigation Channel
PCB: Polychlorinated biphenyl
RT: Remediation threshold
SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
2. The remediation threshold (RT) footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft Feasibility Study for the Portland Harbor.

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP
Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-2

Proposed Surface Sediment Sampling Stations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 120 240 360
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-2_Proposed_Surface_Sed_Sampling_Overview_.mxd

LEGEND

- Sub-Bottom Profile
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- U.S. Army Corps of Engineers Navigation Channel
- 5' Elevation Contour
- Building/Structure

NOTES

SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP
Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-3

Proposed Sub-Bottom Profile Transects

River Mile 11 East
Willamette River
Portland, Oregon

N

0 30 60 90
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-3_SubBottom_Profile_.mxd

LEGEND

- Proposed Sample Location
- Sample Grid
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- U.S. Army Corps of Engineers Navigation Channel
- 5' Elevation Contour
- Building/Structure

NOTES

SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP

Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-4

Proposed Sediment Profile Imaging Survey Locations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 30 60 90
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-4_GRID_SPI.mxd

LEGEND

- Proposed Sonic Core Location
- Proposed Vibracore Location
- Historical Subsurface Sediment Sample
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Anchored Soldier Pile Retaining Wall
- Cantilevered Soldier Pile Wall
- Bulkhead Wall
- 5' Elevation Contour
- Building/Structure

NOTES

SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP
Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-5

Proposed Subsurface Sediment Sampling Stations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 120 240 360
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-5_Proposed_Subsrface_Sed_Sampling_Overview.mxd

LEGEND

- Proposed Subsurface Sampling Location
- Pre-Selected Bulk Sediment Sample Location
- Bulk Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Anchored Soldier Pile Retaining Wall
- Cantilevered Soldier Pile Wall
- Bulkhead Wall
- 5' Elevation Contour
- Building/Structure

NOTES

SMA: Sediment Management Area

1. The SMA footprints were delineated in the Basis of Design Report using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

This figure is taken from the March 2020 RM11E Phase 1 RD Sediment SAP
Date: March 20, 2020
Data Sources: USACE, METRO, DEA

FIGURE 3-6

Proposed Bulk Sediment Sampling Stations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 80 160 240
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure3-6_Bulk_Sed_Sample_locs.mxd

LEGEND

2009 Coring Location

Number of Coring Attempts

- 1
- 2
- 3

Core Label

ID, Drive Length, Recovery Length, % Recovery

Target Depth Achieved

- No
- Yes

Percent Recovery

- 90% - 100%
- 70% - 89%
- 50% - 69%
- 25% - 49%

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Building/Structure

NOTE

1. The SMA footprints were delineated in the BODR using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

Date: March 17, 2020
Data Sources: USACE, METRO, DEA

FIGURE 4-1

Historical Coring Locations

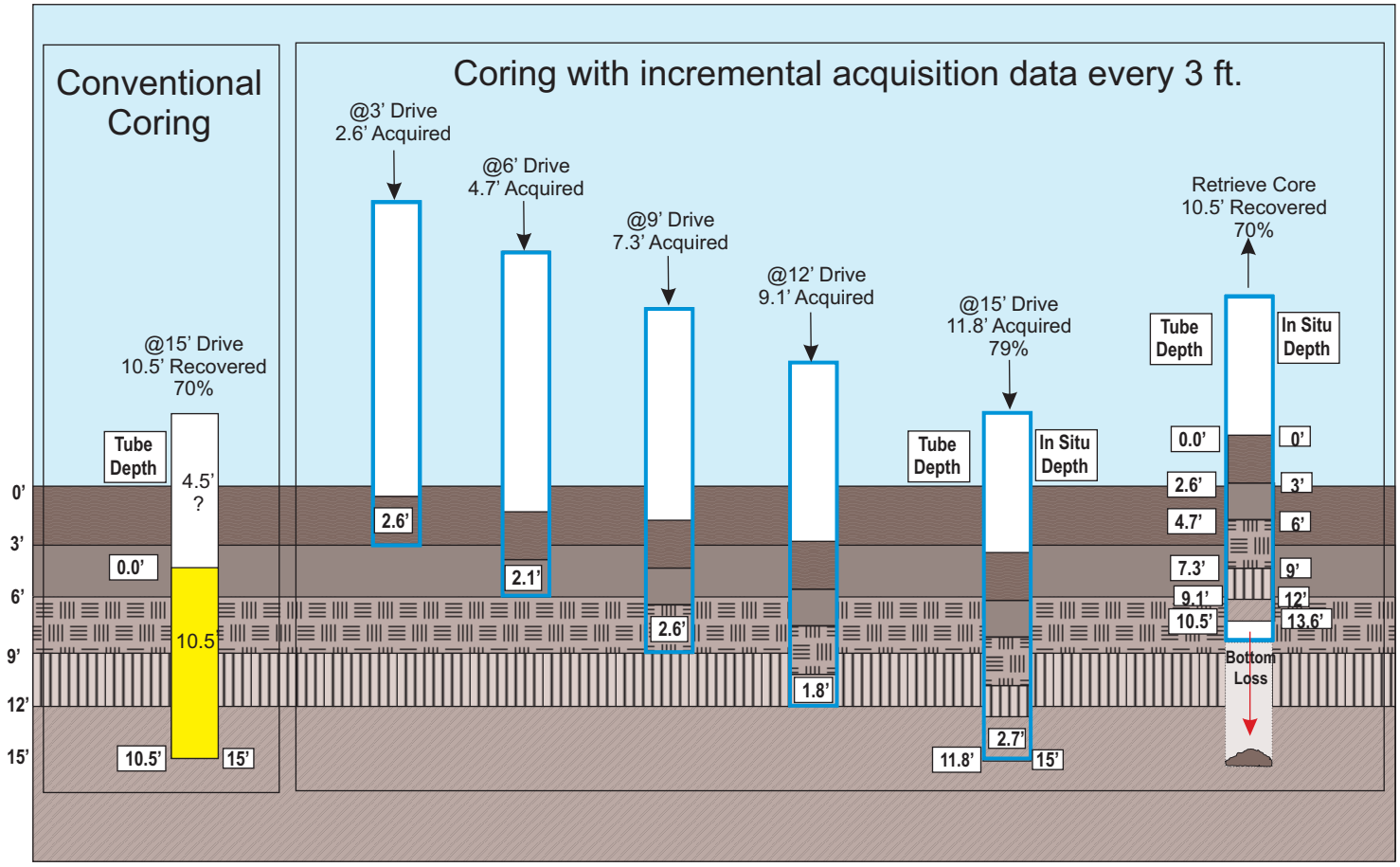
River Mile 11 East
Willamette River
Portland, Oregon

N

0 80 160 240
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\Report\Figure4-1_Historic_Coring.mxd



RM11E Group
Willamette River - Portland Oregon

Phase I RD Sampling

Coring with Incremental Acquisition Data

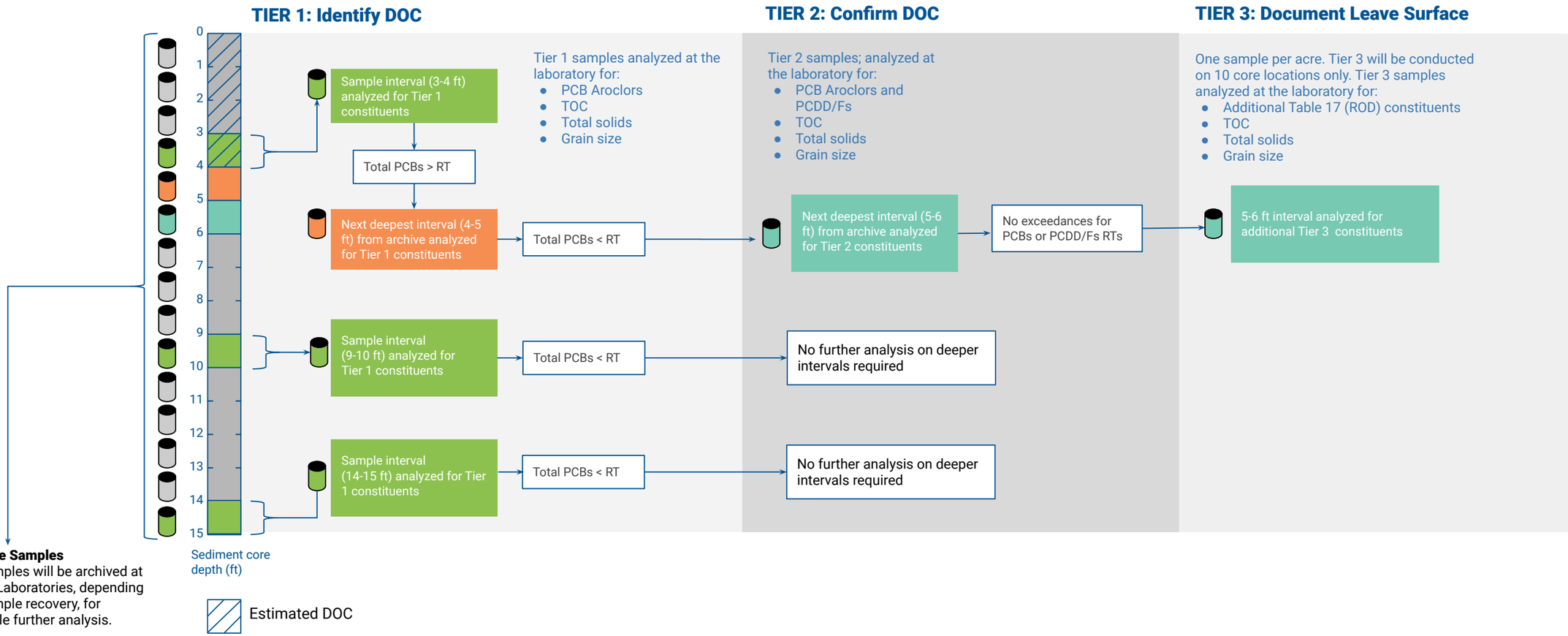
DALTON OLMSTED FUGLEVAND

FIGURE 4-2

February 2020

This page intentionally left blank.

Figure 5-1 Example of Tiered Analytical Approach



Archive Samples
All samples will be archived at APEX Laboratories, depending on sample recovery, for possible further analysis.

Notes
Sampling intervals may be based on historical data, where applicable.
Table 17 (ROD) analysis is for constituents from the Portland Harbor Superfund Site Record of Decision (EPA, 2017).

Abbreviations and Acronyms
COC = contaminant of concern
DOC = depth of contamination
ft = foot or feet
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)
RT = Remediation Threshold
TOC = total organic carbon

This page intentionally left blank.

Attachments

This page intentionally left blank.

ATTACHMENT 1

RM11E - Project Area and Sediment Management Areas Technical Memorandum

This page intentionally left blank.

Technical Memorandum

To: RM11E Group

From: Erin Carroll Hughes, GSI Water Solutions, Inc.
Dave Livesay, GSI Water Solutions, Inc.

Date: October 19, 2017

Re: **RM11E - Project Area and Sediment Management Areas**

The April 15, 2013 Administrative Settlement Agreement and Order on Consent (AOC) defines the River Mile 11E (RM11E) Project Area as follows:

> *"RM11E Project Area" shall mean the area on the east side of the Willamette River, generally spanning from River Mile 10.9 to River Mile 11.6 and encompassing approximately 38 acres, within the Portland Harbor Superfund Site (Portland Harbor), and generally located on or adjacent to properties owned by Cargill, Inc., Glacier Northwest, and Ross Island Sand & Gravel at 800 North River Street, 1050 North River Street, and 1208 North River Street, respectively in Portland, Multnomah County, Oregon. The River Mile 11E Project Area is generally depicted in Appendix B to this Settlement Agreement. The River Mile 11E Project Area includes sediment, surface water, and groundwater where elevated concentrations of polychlorinated biphenyls (PCBs) and other contaminants have been detected and which are presenting unacceptable risk in the Willamette River. The final extent of the area will be determined in accordance with the Process described in the SOW.*

The RM11E Project Area extent, from Appendix B to the AOC, is shown in Figure 1 (figures are presented at the end of this technical memorandum). The RM11E Group is currently discussing an amendment to the AOC and new Scope of Work (SOW) with EPA to address remedial design for the Project Area.

A Sediment Management Area (SMA) is the term used in the Portland Harbor Feasibility Study (FS; EPA, 2016b) and Record of Decision (ROD; EPA, 2017) to describe an area where active remediation (i.e., containment or removal technologies) is anticipated to be evaluated, designed and applied to reduce sediment exposure concentrations. An SMA is an area where one or more focused contaminant of concern (COC) concentrations exceed Remedial Action Levels (RALs; described below) and natural recovery is not likely to be effective in reducing concentrations to acceptable levels within a reasonable time frame.

In the August 29, 2017 draft Scope of Work (SOW) for Remedial Design provided to the RM11E Group, the U.S. Environmental Protection Agency (EPA) referenced Figures 30 and 31e of the ROD (see Attachment A of this technical memorandum) to describe the RM11E SMA. Figure 30 of the ROD spans the entire Portland Harbor with no specific limits of any SMAs, including at RM11E. Figure 31e of the ROD spans from RM 10 to RM 12 of the Willamette River and, as with Figure 30, shows various areas on both the east bank and west bank of the river in which active remediation is anticipated, but with no delineation around what EPA considers to be the RM11E "area for remedial design" under the new draft SOW currently being discussed between the RM11E Group and EPA. In addition, EPA agreed during a September 26, 2017 meeting with the RM11E Group that the maps in the ROD, presenting information about the RM11E Project Area, do not incorporate all of the available EPA-approved data collected at RM11E, including data collected under the RM11E AOC, and that common artifacts of the mapping techniques used to create the maps may have resulted in maps that do not accurately reflect the sediment areas needing active remediation in the vicinity of RM11E.

At the request of the RM11E Group, GSI Water Solutions, Inc. (GSI), prepared more detailed COC and SMA maps using the full RM11E dataset and EPA-approved data in areas adjacent to RM11E in order to provide a technical assessment of the appropriate project area for the new SOW. This technical memorandum provides that assessment, including clarification on and definition of the full RM11E dataset, as well as the mapping techniques used by the RM11E Group to delineate the SMAs.

Portland Harbor COCs, RALs, and SMAs

The Portland Harbor risk assessments identified 64 COCs that may pose unacceptable risk to the human and ecological receptors evaluated. To simplify analysis and evaluation of remedial alternatives for the Portland Harbor FS, a subset of all COCs, called focused COCs, was developed by EPA by evaluating collocation of all COCs, their toxicity, and significance in the risk assessments as well as other factors outlined in the Portland Harbor Remedial Investigation (RI). The six focused COCs for Portland Harbor are:

1. Total polychlorinated biphenyls (PCBs)
2. Total polycyclic aromatic hydrocarbons (PAHs)
3. Total DDx[1]
4. 2,3,7,8- Tetrachlorodibenzo-p-dioxin (TCDD)
5. 1,2,3,7,8- Pentachlorodibenzo-p-dioxin (PeCDD)
6. 2,3,4,7,8- Pentachlorodibenzofuran (PeCDF)

A range of contaminant-specific sediment concentrations, referred to as RALs, was assigned to each focused COC to identify areas where capping and/or dredging would be designated under the various alternatives evaluated in the Portland Harbor FS. The outer bounds of the

[1] Total DDx is a term used to refer to the combined dichlorodiphenyltrichloroethane (DDT) and breakdown compounds dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD). In particular, it is calculated as the sum of 2,4'-DDD; 4,4'-DDD; 2,4'-DDE; 4,4' DDE; 2,4'-DDT; and 4,4'-DDT.

combined footprints of the focused COC concentrations in surface sediment that exceed RALs, serve as the basis of the SMA footprints evaluated under each FS alternative (Alternatives A through I).

Alternative F Modified (F Mod) is the FS alternative that EPA selected in the ROD for Portland Harbor. Alternative F Mod uses different RALs for the nearshore areas vs. those areas that are within the Federal Navigation Channel (Nav Channel). The applicable RALs or Principal Threat Waste (PTW) thresholds used to define SMAs are presented in Table 1 (below). These RALs define contaminant concentrations at which monitored natural recovery (MNR) and engineered natural recovery (ENR) are presumptively not considered to adequately address remedial action objectives (RAOs) in a reasonable time frame. As noted in the ROD, the COCs used to define the SMA boundaries encompass the majority of the spatial extent of contaminants posing the majority of the risks as identified in the baseline risk assessments.

Table 1. Portland Harbor RALs

	Applicable Area	Nearshore Areas	Navigation Channel
Focused COC (Analyte)	Units		
Total PCBs	ug/kg	75	200
Total PAHs	ug/kg	13,000	170,000
Total DDx	ug/kg	160	650
2,3,7,8-TCDD	ug/kg	0.0006	0.002
1,2,3,7,8-PeCDD	ug/kg	0.0008	0.003
2,3,4,7,8-PeCDF	ug/kg	0.2	0.2

RM11E SMAs

Figure 30 of the ROD shows SMA footprints for the selected Alternative F Mod remedy for the entire Portland Harbor. However, those footprints do not accurately reflect contaminant distribution in the vicinity of RM11E because map interpolations did not include recent RM11E data and did not correct for mapping artifacts, such as the nearshore area on the east bank between RM 10.5 and RM 11 that did not incorporate mapping boundaries[2].

Therefore, SMA boundaries have been updated by GSI using the most current dataset along with the ROD RALs as shown in Table 1. Mapping techniques are discussed below and the updated maps of RAL exceedances are provided as Figures 2 through 7[3] for the six focused COCs. The combined Alternative F Mod SMAs for all COCs for the selected remedy between RM10 and RM12 are shown on Figure 8.

[2] See EPA Response to UPPR Dispute 6 in Attachment A of this Technical Memorandum (extracted from Appendix A of the ROD).

[3] Note that Figures 2 through 7, EPA sample locations are shown as tan colored squares behind the complete RM11E sample location dataset. Where EPA data aligns with the RM11E data, the symbol shows up with a tan halo behind it. When EPA is missing the RM11E sample in their dataset, no halo shows up around the associated RM11E sample location.

Surface Sediment SMA Mapping Technique

The following actions were taken using ArcGIS software to delineate contaminant specific footprints exceeding RALs, and the resulting combined SMA between RM 10 and RM 12:

1. Plotting applicable surface sediment data for each focused COC. Note that applicable sediment data were compiled using the following guidelines:
    - Includes only data classified as surface sediment. This includes any bank soil and sediment samples collected at an elevation of less than or equal to 13 feet North American Vertical Datum of 1988 (NAVD88). Depths for sediment data have been categorized as follows: surface sediments are defined as samples with a start depth of zero and end depth of less than or equal to 30 centimeters (cm)[4]. All other samples are considered to be subsurface sediments.
    - Per RI data selection rules, includes data that had a quality assurance (QA) approval code indicating a Category 1-level of data quality and either a level of validation of "QA1" or "QA2" (see Section 2.1 of Integral et al. [2011]). Category 1-level data have undergone validation and are considered to be of known quality.
    - Excludes analytical results from sample locations that have been dredged after sampling occurred. The locations of these samples are provided for reference in Figures 2 through 7, but sample results are not included in the generation of the RAL exceedance footprints (Steps 2 through 5 below).
    - For analyte group totals (e.g., Total PCBs), parameters are summed using the FS convention for the treatment of non-detects, where non-detects were assumed to be half (0.5) of the method detection limit (MDL); if all parameters in a sum were non-detects, the value was set to the highest reported MDL.
    - When organochlorine pesticide data were available from multiple analytical methods for the same sample location, results obtained through the high resolution gas chromatography/tandem mass spectrometry (HRGC/MS/MS) method (EPA 1699M) replaced the results obtained via the initial conventional pesticide method performed by gas chromatography/electron capture detection (GC/ECD) primarily using EPA Method 8081A. This is because the high resolution method provides higher quality data, both in terms of result accuracy and lower detection limits. Where high resolution data were not available, conventional data were used. Available HRGC/MS/MS results are symbolized differently than conventional pesticide results in Figure 4 for reference.
    - Sixteen of the surface sediment sampling locations have been reoccupied and analyzed subsequent to when the initial sample was collected. Successfully reoccupied sampling locations are considered to be those that were collected within 15 feet of the initial sample station. Where available, the more recent analytical data from that station replace data from the original sample. The

[4] While most surface sediment samples extend up to 30 cm (approximately 1 foot) below mudline, some samples extended up to 40 cm below mudline and have been included as "surface sediment" for completeness, as "subsurface sediment" is defined in the Portland Harbor FS as material with an end depth of greater than 40 cm.

original sample location is still shown as a square with an "X" in Figures 2 through 7, but the original sample result is not used in the delineation of the RAL exceedance footprints (Steps 2 through 5 below).

2. Performing a Natural Neighbors geostatistical interpolation to generate a concentration raster with 10-foot grid cells for each of the focused COCs in ArcGIS using all applicable surface sediment point data, described in Step 1 above.
3. Clipping the resultant focused COC concentration rasters to the mean high water line of 13 feet NAVD88.
4. Using the Natural Neighbors rasters to delineate polygons that outline areas that exceed the appropriate RALs for the nearshore and Nav Channel areas.
5. Identifying apparent RAL exceedance polygons that do not contain sample points and are therefore driven by data outside of the immediate area. These areas are referred to as "Mapping Artifacts" in Figures 2 and 6 and are not carried forward into the combined SMA in Figure 8.[5] In looking at Figure 31e of the ROD, EPA also appears to have removed some of these mapping artifacts for example, Total PCBs and 1,2,3,7,8-PeCDF at RM 10.7W.
6. Merging the RAL exceedance areas for all focused COCs together to delineate the full combined SMAs that are anticipated to require active remediation. The outer boundary of the overlapping RAL exceedance areas between RM 10 and RM 12, i.e., the SMAs, are shown for reference in Figure 8.

Comparison to EPA's SMAs

As noted in EPA's response to UPPR Dispute #6 on the Final FS (Attachment A), EPA has confirmed that there are no samples that exceed RALs in the nearshore SMA shown at approximately RM 10.7E on ROD Figure 31e and that the SMA in this area is an artifact of computer interpolation processes because boundaries were not used in the computer interpolation process. Based on a review of EPA's Figures 3.4-7 through 3.4-12 of the Portland Harbor FS, Total PCBs appear to be driving the delineation of the SMA that is shown on the east bank between RM 10.5 and RM 11 in Figures 30 and 31e of the ROD (Attachment A). To evaluate why EPA's SMA boundaries presented in the ROD differ from the SMAs delineated by GSI between RM 10.5 and RM 11, two figures were prepared for Total PCBs to determine whether the difference in the sampling dataset could explain the apparent mapping artifact observed on the east bank between RM 10.5 and RM 11.

- **Figure 9 (Upper Panel) –Total PCB RALs (EPA Dataset)**. This map was generated using all applicable "Total PCB (Calc'd)" results from the SCRA Database dated February 8, 2016, and provided in Appendix A3 of the *Final Remedial Investigation Report for Portland Harbor* (EPA, 2016a). The RAL contours were generated using the Natural Neighbor mapping techniques described in Steps 2 and 3 above. For the sake of comparison to Figure 3.4-7 of the Portland Harbor FS, the RAL exceedance areas for all FS alternatives are shown. The impact of this figure on SMAs can be deciphered by looking at

[5] The mapping artifacts identified through this exercise are not located within the RM11E Project Area.

concentrations greater than the Alternative F RAL in the nearshore areas and the Alternative E RAL in the Nav Channel.

- **Figure 9 (Lower Panel) – Total PCB RALs (RM11E Dataset)**. This map uses the comprehensive dataset from RM11E dataset shown on Figure 2 and described above (RM11E Dataset). The Natural Neighbor raster shows all of the FS Alternative RALs for comparison to the interpolation of EPA data presented on the upper panel in Figure 9.

Comparison of the upper and lower panels on Figure 9 illustrates that the SMA on the east bank between RM 10.5 and RM 11 using EPA's data alone results in a nearshore mapping artifact. PCBs were not detected above the RALs in this area. As shown on the lower panel, the mapping artifact is not generated using the RM11E Dataset. A likely reason is therefore that EPA did not include results of the 23 shoreline sediment samples (with sample IDs starting with RM11E-SL0xx) and the recent RM11E Supplemental RI/FS data in its interpolation; thus the Natural Neighbor interpolation is not bounded along the shoreline in the Agency's dataset. Furthermore, this appears to be the case for the other focused COCs, so the shapes of EPA's RAL exceedance areas and the RM11E Groups RAL exceedance areas will also vary for these analytes.

Further support for the conclusion that the nearshore mapping artifact on the east bank between RM 10.5 and RM 11 does not reflect actual sediment conditions is the fact that five samples were taken adjacent to the artifact area (see sample locations in Figure 9), all of which were below ROD RALs, demonstrating that the apparent contamination in that area was artificially generated though the mapping process.

Another area where the use of the RM11E Dataset improves the accuracy of the mapping and demonstrates that the Total PCB RAL exceedance footprints shown in FS Figure 3.4-7 overestimate the extent of PCB impact, is on the east bank between RM 11.5 and 11.7. Comparison of the upper and lower panels of Figure 9 indicates that, when the more recent RM 11E data in this area is used for mapping, the Total PCB concentrations above RALs upstream of the Project Area are more confined than indicated in FS Figure 3.4-7. Accordingly, the SMA footprints are more confined than indicated in ROD Figures 30 and 31e.

Conclusions

As illustrated in Figure 8, there are three distinct sets of SMAs between RM 10 and RM 12. First are the SMAs that are substantively contained within the RM11E Project Area, as defined by the April 2013 AOC. The other two SMAs are observed between RM 10 and RM 10.1 on the east bank and RM 10.1 to RM 10.3 on the west bank. These RM10E and RM10W SMAs are: outside of EPA's RM11E Sediment Decision Unit (SDU) boundary; outside of the RM11E AOC/SOW Project Area boundary for work performed by the RM 11E Group to date; bounded by concentrations below RALs (see Figures 2 through 7); and adjacent to the following known or suspected upland source areas:

- **RM 10E - PCBs.** The PCB SMA at RM10E is driven by one sample with a concentration of 580 ug/kg (WLCAYH00SD04SD04S). This sample is located adjacent to a Union Pacific Railroad (UPRR) outfall WR-218 and was collected in August 2000 to support the UPRR Albina Yard Expanded Preliminary Assessment Data Report. The UPRR Albina Yard (ECSI #178) is located at 1135 N Knott St. Contaminants detected in soil at that location included metals, PAHs, hydrocarbons, PCBs and VOCs. Contaminants detected

in groundwater at that location included metals, PAHs and hydrocarbons. Contaminants detected in adjacent Willamette River sediments included lead, zinc, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, di-n-octylphthalate, and PCBs. A Final Remedial Investigation/Source Control Measures Evaluation Report was submitted to DEQ in 2011 and a formal FS was submitted in 2012. DEQ issued a No Further Action determination in 2014.

- **RM 10E - PAHs.** Two Total PAH sediment samples collected as part of the Goldendale Aluminum Phase 2 task are driving the Total PAH SMA in this area. Those samples exceed RALs with concentrations of 32,000 ug/kg (WLCGAL00GAPD02APD02D) and 46,000 ug/kg (WLCGAL00GAPD02APD02D). Goldendale Aluminum (ECSI #2440) is located at 2600 N River St. Contaminants detected in adjacent Willamette River sediments included arsenic, lead, zinc, bis(2-ethylhexyl)phthalate, butylbenzophthalate, di-n-octylphthalate, dibenzofuran, and LPAHs (total). DEQ issued a No Further Action determination for the location in 2014.
- **RM 10.2W - PCBs.** This area is adjacent to the Sulzer Pump facility (ECSI Site #1235), located at 2800 NW Front Avenue. Sulzer conducts the machining, assembly, testing, and finishing of pumps and pump components. In 1990, soil and groundwater contamination associated with gasoline and waste oil tanks was discovered during removal of 12 underground storage tanks (USTs). Removal of all contaminated soil from two UST pits could not be accomplished. Groundwater remains contaminated with BTEX (benzene, toluene, ethylbenzene, and xylene) and chlorinated solvents. A draft groundwater, stormwater, and bank erosion source control evaluation was submitted to DEQ in 2015. This Source Control Evaluation Report for the Sulzer Pumps Facility reports Total PCB concentrations in catchbasin sediment up to 397 ug/kg near Outfall C-1 (GeoDesign, 2015). Numerous bank soil samples also had high PCB detections in excess of the nearshore RAL, with the highest concentration of 195 ug/kg.

As shown in Figure 8, the SMAs in the vicinity of RM11E are substantively contained within the current RM11E Project Area boundary as defined by the April 2013 AOC (see Figure 10). While PCBs are the primary risk driver in this area, one Total PAH sample result at RM 12.5 and several dioxin furan (i.e., 1,2,3,7,8-PeCDD and 2,3,7,8-TCDD) sample results between RM 11.4 and RM 11.6 extend the SMA beyond the PCB RAL exceedance footprint approximately 65 feet beyond the southern extent of the RM11E Project Area boundary. This is primarily due to fewer sediment samples being analyzed for dioxins and furans from the southern extent of the Project Area, which in turn, results in Natural Neighbor interpolation likely overestimating the extent of the dioxin/furan congener footprints.

Additional samples will be collected during remedial design to further delineate the active cleanup area. Based on the analysis provided herein, GSI considers the SMA boundary shown in Figure 10 to be the best representation of the "RM11E SMAs" based on existing data and is the SMA boundary that GSI recommends carrying forward into the Recontamination Assessment Report and the Basis of Design Report. Accordingly, GSI recommends that the RM11E Project Area be retained as shown in Appendix B of the AOC with refinements made, as needed, during the Remedial Design process.

Sincerely,
GSI Water Solutions, Inc.

Erin Carroll Hughes
Project Manager
971-200-8528

Dave Livesay
Project Supervisor
971-200-8501

References

EPA, 2016a. Final Remedial Investigation Report. Portland Harbor RI/FS. February 8, 2016. U.S. Environmental Protection Agency Region 10, Seattle, WA.

EPA, 2016b. Feasibility Study Report. Portland Harbor RI/FS. June 2016. U.S. Environmental Protection Agency Region 10, Seattle, WA.

EPA, 2017. Record of Decision. Portland Harbor Superfund Site. Portland, Oregon. January 2017. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, DC.

GeoDesign, 2015. Source Control Evaluation Report. Sulzer Pumps Facility (DEQ ECSI No. 1235). May 7, 2015. GeoDesign, Inc, Portland, Oregon.

Attachments

Figures (1-10)
Attachment A

Figures

Figure 1 – River Mile 11 East Project Area

Figure 2 – Total PCB RAL Exceedance Areas

Figure 3 – Total PAH RAL Exceedance Areas

Figure 4 – Total DDx RAL Exceedance Areas

Figure 5 – 2,3,7,8-TCDD RAL Exceedance Areas

Figure 6 – 1,2,3,7,8-PeCDD RAL Exceedance Areas

Figure 7 – 2,3,4,7,8-PeCDF RAL Exceedance Areas

Figure 8 – Sediment Management Areas (RM 10 to 12)

Figure 9 – Total PCB RALs (EPA vs. RM11E Dataset)

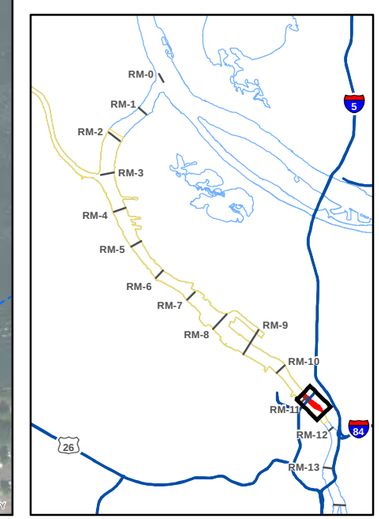
Figure 10 – RM11E Project Area and Sediment Management Areas

FIGURE 1
River Mile 11 East Project Area

Willamette River
Portland, Oregon

LEGEND

- RM11E Project Area (dashed line indicates inferred top of bank)
- AOPC 25[4]
- Shoreline Properties
- U.S. Army Corps of Engineers Navigation Channel
- River Mile (RM) Tenths



MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RM = River Mile
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2012 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The river mile (RM) designations are based on USACE stationing along the centerline of the Lower Willamette River navigation channel and represent the distance in miles from the start of channel at the Columbia River (USACE Portland District Hydrosurvey file WR_2014_Channel.DXF).

N

0 150 300
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure1_RM11E_Project_Area.mxd

FIGURE 2
Total PCB RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- Total PCB RAL Exceedance Area
- Mapping Artifact[9]

Total PCBs in Surface Sediment[6,7]

- Nav Channel RALs: >200 ug/kg
- Nearshore RALs: >75 - 200 ug/kg
- Below RALs: 0 - 75 ug/kg
- Non-Detect (Points Only)
- Re-Occupied Supplemental RI/FS Surface Sediment Sample
- Existing Surface Sediment Sample
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[8]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
PCB = Polychlorinated Biphenyl
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2013 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The Total PCB RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. For consistency with the Portland Harbor RI/FS, "Total PCB" concentrations shown rely upon PCB congener data where available and PCB Aroclor data where PCB congener analysis was not conducted.
7. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total PCB concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
8. EPA samples reflect all "Total PCB (Calc'd)" results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).
9. No sample data present to support this region as a Sediment Management Area. This is a mapping artifact from the GIS Natural Neighbor analytical process.

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure2_Total_PCBs_RAL_Exceedance.mxd

FIGURE 3
Total PAH RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- Total PAH RAL Exceedance Area

Total PAHs in Surface Sediment[6]

- Nav Channel RALs: >170,000 ug/kg
- Nearshore RALs: >13,000 - 170,000 ug/kg
- Below RALs: 0 - 13,000 ug/kg
- Non-Detect (Points Only)
- Existing Surface Sediment Sample
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[7]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in summer 2014 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The Total PAH RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
6. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total PAH concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
7. EPA samples reflect all 'Total PAHs (calc"d)' results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure3_Total_PAHs_RAL_Exceedance.mxd

FIGURE 4
Total DDx RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- Total DDx RAL Exceedance Area

Total DDx in Surface Sediment[6]

- Nav Channel RALs: >650 ug/kg
- Nearshore RALs: >160 - 300 ug/kg
- Below RALs: 0 - 160 ug/kg
- Non-Detect (Points Only)
- Conventional Surface Sediment Sample
- High-Resolution Surface Sediment Sample
- Sample Replaced
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[7]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
1. The locations of all features shown are approximate.
2. Aerial photo base taken in summer 2014 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The Total DDx RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the LWG in the Draft FS for the Portland Harbor (and shown in Figure 1-2.)
6. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total DDx concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
7. EPA samples reflect all 'Total DDTs (calc"d)' results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure4_Total_DDx_RAL_Exceedance.mxd

FIGURE 5
2,3,7,8-TCDD RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- 2,3,7,8-TCDD RAL Exceedance Area

2,3,7,8-TCDD in Surface Sediment[6]

- Nav Channel RALs: >0.002 ug/kg
- Nearshore RALs: >0.0006 - 0.002 ug/kg
- Below RALs: 0 - 0.0006 ug/kg
- Non-Detect (Points Only)
- Re-Occupied Supplemental RI/FS Surface Sediment Sample
- Existing Surface Sediment Sample
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[7]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in summer 2014 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The 2,3,7,8-TCDD RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total 2,3,7,8-TCDD concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
7. EPA samples reflect all '2,3,7,8-Tetrachlorodibenzo-p-dioxin' results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure5_2378_TCDD_RAL_Exceedance.mxd

FIGURE 6
1,2,3,7,8-PeCDD RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- 1,2,3,7,8-PeCDD RAL Exceedance Area
- Mapping Artifact[7]

1,2,3,7,8-PeCDD in Surface Sediment[6]

- Nav Channel RALs: >0.003 ug/kg
- Nearshore RALs: >0.0008 - 0.003 ug/kg
- Below RALs: 0 - 0.0008 ug/kg
- Non-Detect (Points Only)
- Re-Occupied Supplemental RI/FS Surface Sediment Sample
- Existing Surface Sediment Sample
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[8]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in summer 2014 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The 1,2,3,7,8-PeCDD RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total 1,2,3,7,8-PeCDD concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
7. No sample data present to support this region as a Sediment Management Area. This is a mapping artifact from the GIS Natural Neighbor analytical process.
8. EPA samples reflect all '1,2,3,7,8-Pentachlorodibenzo-p-dioxin' results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure6_12378_PeCDD_RAL_Exceedance.mxd

FIGURE 7
2,3,4,7,8-PeCDF RAL Exceedance Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

- 2,3,4,7,8-PeCDF RAL Exceedance Area

2,3,4,7,8-PeCDF in Surface Sediment[6]

- Nearshore and Nav Channel RALs: >0.2 ug/kg
- Below RALs: 0 - 0.2 ug/kg
- Non-Detect (Points Only)
- Re-Occupied Supplemental RI/FS Surface Sediment Sample
- Existing Surface Sediment Sample
- Excluded Due to Capping/Dredging

All Other Features

- EPA Surface Sediment Sample[7]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in summer 2014 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The 2,3,4,7,8-PeCDF RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total 2,3,4,7,8-PeCDF concentrations were calculated using the Portland Harbor FS (RA/background) data rules.
7. EPA samples reflect all '2,3,4,7,8-Pentachlorodibenzofuran' results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure7_23478_PeCDF_RAL_Exceedance.mxd

FIGURE 8
Sediment Management Areas
River Mile 10 to 12

Willamette River
Portland, Oregon

LEGEND

Sediment Management Area

RAL Exceedance Area

Total PCB RAL Exceedance Area

Total DDx RAL Exceedance Area

PAHs RAL Exceedance Area

2,3,7,8-TCDD RAL Exceedance Area

1,2,3,7,8-PeCDD RAL Exceedance Area

All Other Features

RM11E Project Area (dashed line indicates inferred top of bank)

River Mile Tenth

AOPC 25[4]

EPA SDU

U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 18, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
PCB = Polychlorinated Biphenyl
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2013 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. The source of the sediment and soil data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014) and updated in accordance with Section 4.4.3 of the Porewater Characterization Report (GSI, 2015). Total PCB, Total PAH, and Total DDx concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

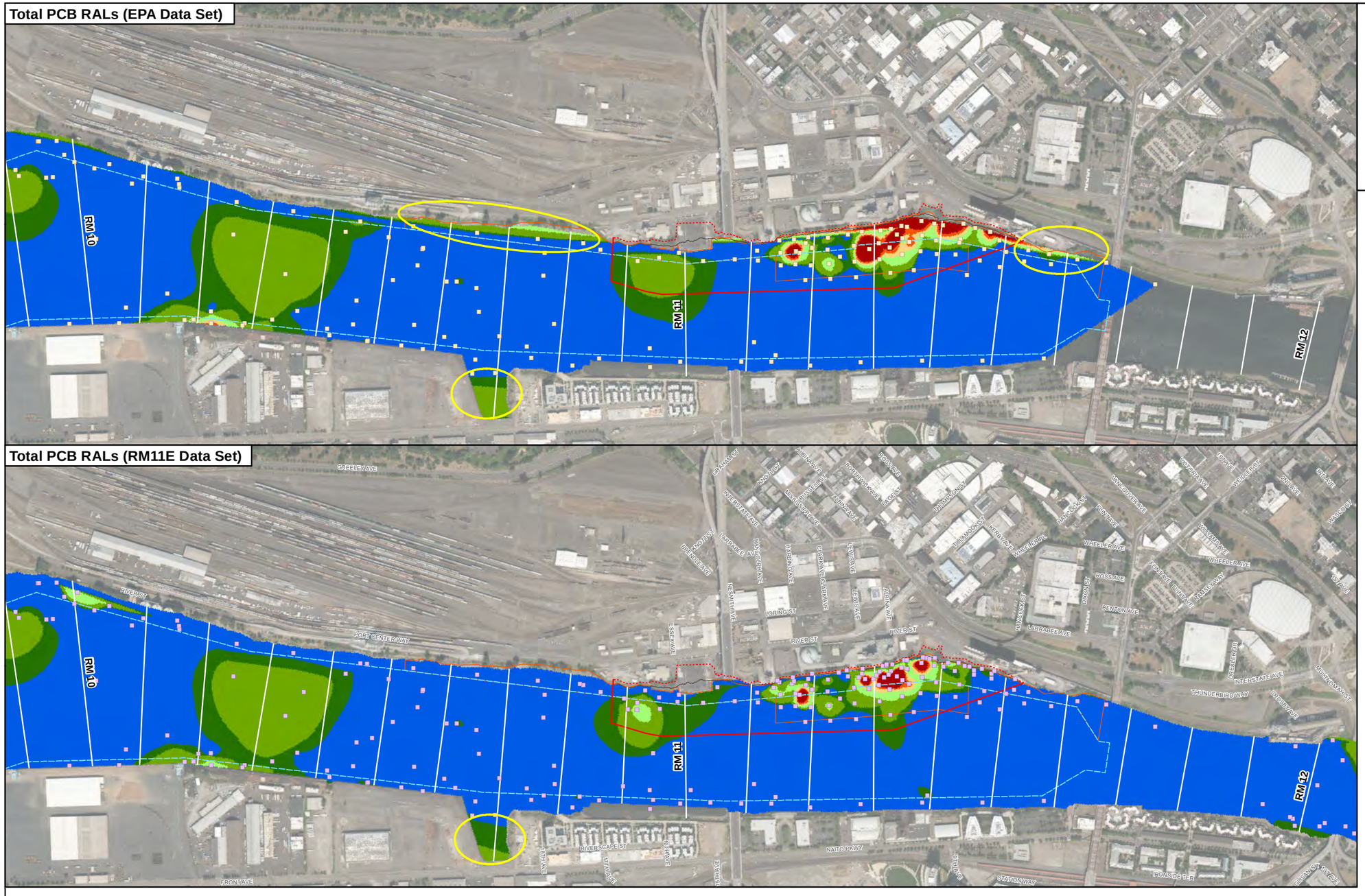
Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure8_SMAs.mxd

FIGURE 9

Total PCB RALs (EPA vs. RM11E Dataset)

River Mile 10 to 12

Willamette River
Portland, Oregon



LEGEND

PCB EPA RALs

- RAL B (>1000 ug/kg)
- RAL C (>750 ug/kg)
- RAL D (>500 ug/kg)
- RAL E (>200 ug/kg)
- RAL F (>75 ug/kg)
- RAL G (>50 ug/kg)
- RAL H (>9 ug/kg)

All Other Features

- EPA Surface Sediment Sample[7]
- RM11E Surface Sediment Samples[8]
- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- Mapping Artifact
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 17, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
PCB = Polychlorinated Biphenyl
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2013 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The Total PCB RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. For consistency with the Portland Harbor RI/FS, "Total PCB" concentrations shown rely upon PCB congener data where available and PCB Aroclor data where PCB congener analysis was not conducted.
7. EPA samples reflect all "Total PCB (Calc'd)" results for surface sediment from the SCRA Database dated February 8, 2016 and provided in Appendix A3 of the Final Remedial Investigation Report for Portland Harbor (EPA, 2016).
8. The source of the sediment data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014). Total PCB concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

N

0 500 1,000
Feet

GSI Water Solutions, Inc.

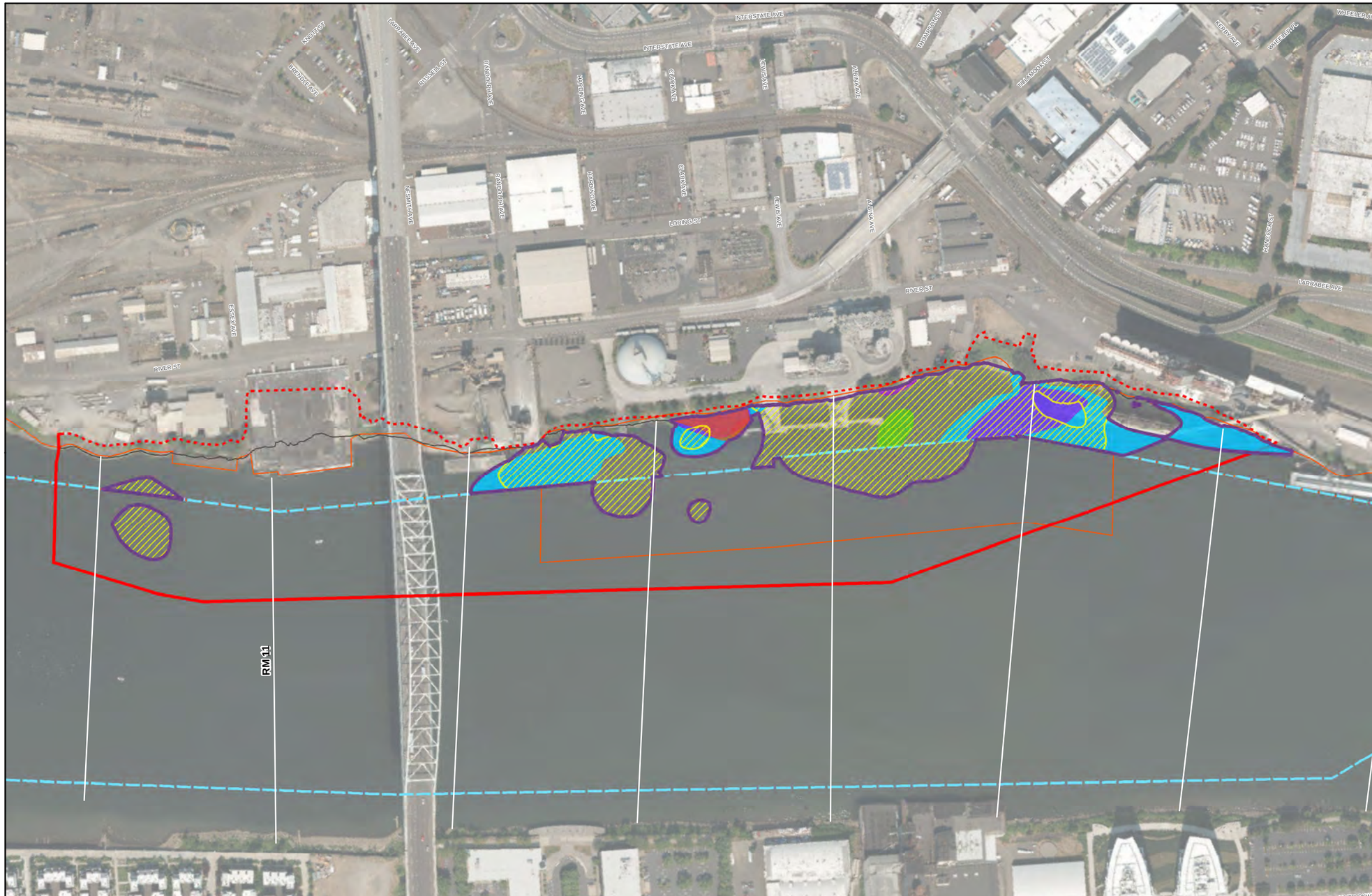
Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure9_PCB_RALs_EPA.mxd

FIGURE 10

RM11E Project Area and Sediment Management Areas

River Mile 10 to 12

Willamette River
Portland, Oregon



LEGEND

- Sediment Management Area

RAL Exceedance Area

- Total PCB RAL Exceedance Area
- Total DDx RAL Exceedance Area
- PAHs RAL Exceedance Area
- 2,3,7,8-TCDD RAL Exceedance Area
- 1,2,3,7,8-PeCDD RAL Exceedance Area

All Other Features

- RM11E Project Area (dashed line indicates inferred top of bank)
- River Mile Tenth
- AOPC 25[4]
- EPA SDU
- U.S. Army Corps of Engineers Navigation Channel

MAP NOTES:

Date: October 18, 2017
AOPC = Area of Potential Concern
FS = Feasibility Study
PCB = Polychlorinated Biphenyl
RAL = Remedial Action Level
RI = Remedial Investigation
1. The locations of all features shown are approximate.
2. Aerial photo base taken in fall 2013 by METRO.
3. RM11E Project Area includes AOPC 25 and the adjacent riverbank area to the top of bank.
4. The AOPC 25 boundary is consistent with the information presented in the Draft FS report for the Portland Harbor (Anchor QEA et al., 2012).
5. The RAL footprints were delineated using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.
6. The source of the sediment and soil data is the RM11E dataset described in Section 10.2 of the Supplemental RI/FS Field Sampling and Data Report (GSI, 2014) and updated in accordance with Section 4.4.3 of the Porewater Characterization Report (GSI, 2015). Total PCB, Total PAH, and Total DDx concentrations were calculated using the Portland Harbor FS (RA/background) data rules.

N

0 250 500
Feet

GSI Water Solutions, Inc.

Document Path: P:\Portland\487-DOF\GIS\Project_mxds\Recontamination_Assessment\SMA\EPAextent\Figure10_RM11E_SMAs.mxd

Attachment A

ROD Figure 30 - Sediment Management Areas, Selected Remedy

ROD Figure 31e - Technology Assignments, Selected Remedy

ROD Appendix A UPPR Dispute Issue 6 Documentation

FS Figure 3.4-7 - PCB RAL Contours

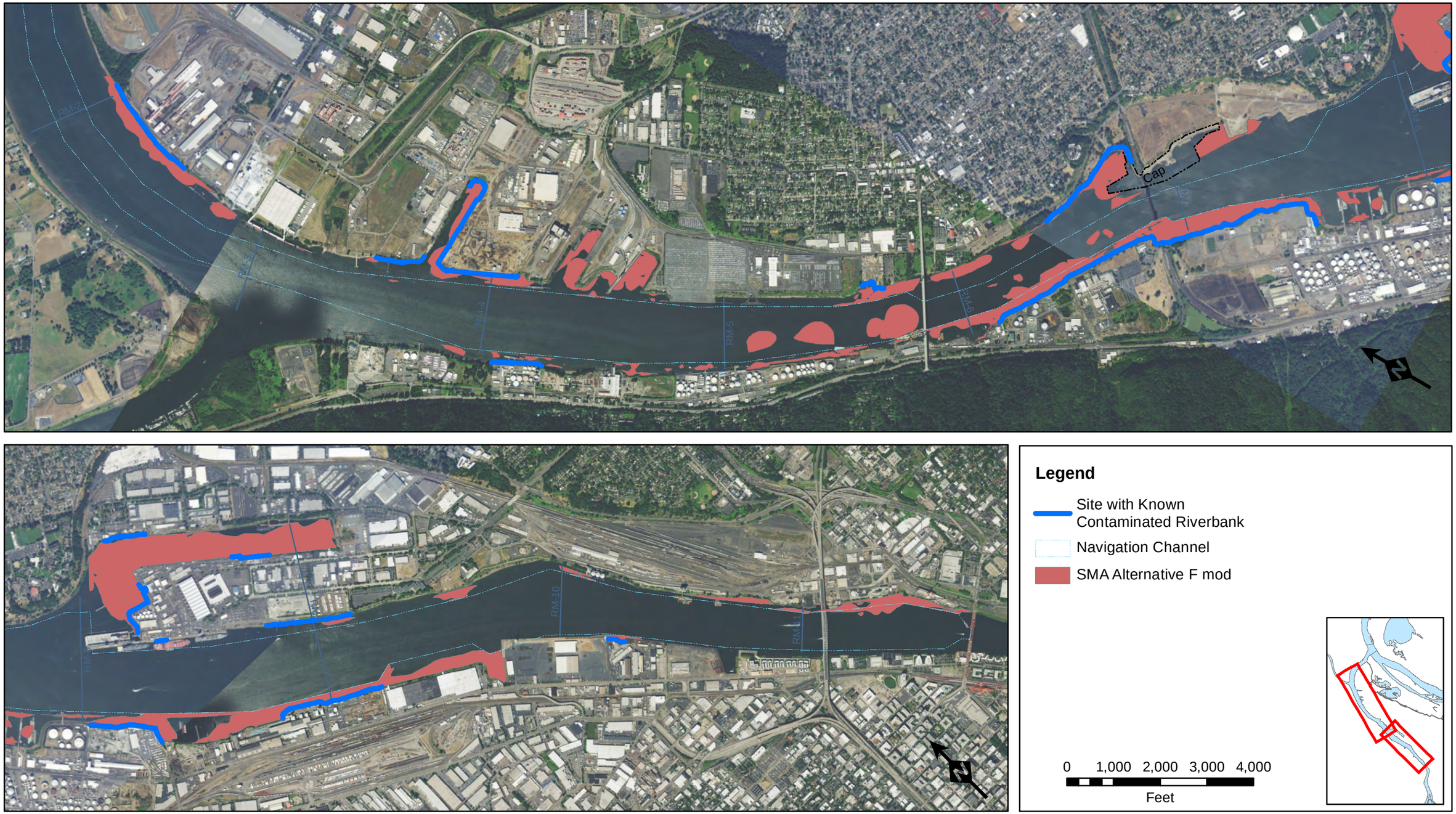
FS Figure 3.4-8 - Total PAH RAL Contours

FS Figure 3.4-9 - 2,3,7,8-TCDD RAL Contours

FS Figure 3.4-10 - 1,2,3,7,8-PeCDD RAL Contours

FS Figure 3.4-11 - 2,3,4,7,8-PeCDF RAL Contours

FS Figure 3.4-12 - DDx RAL Contours



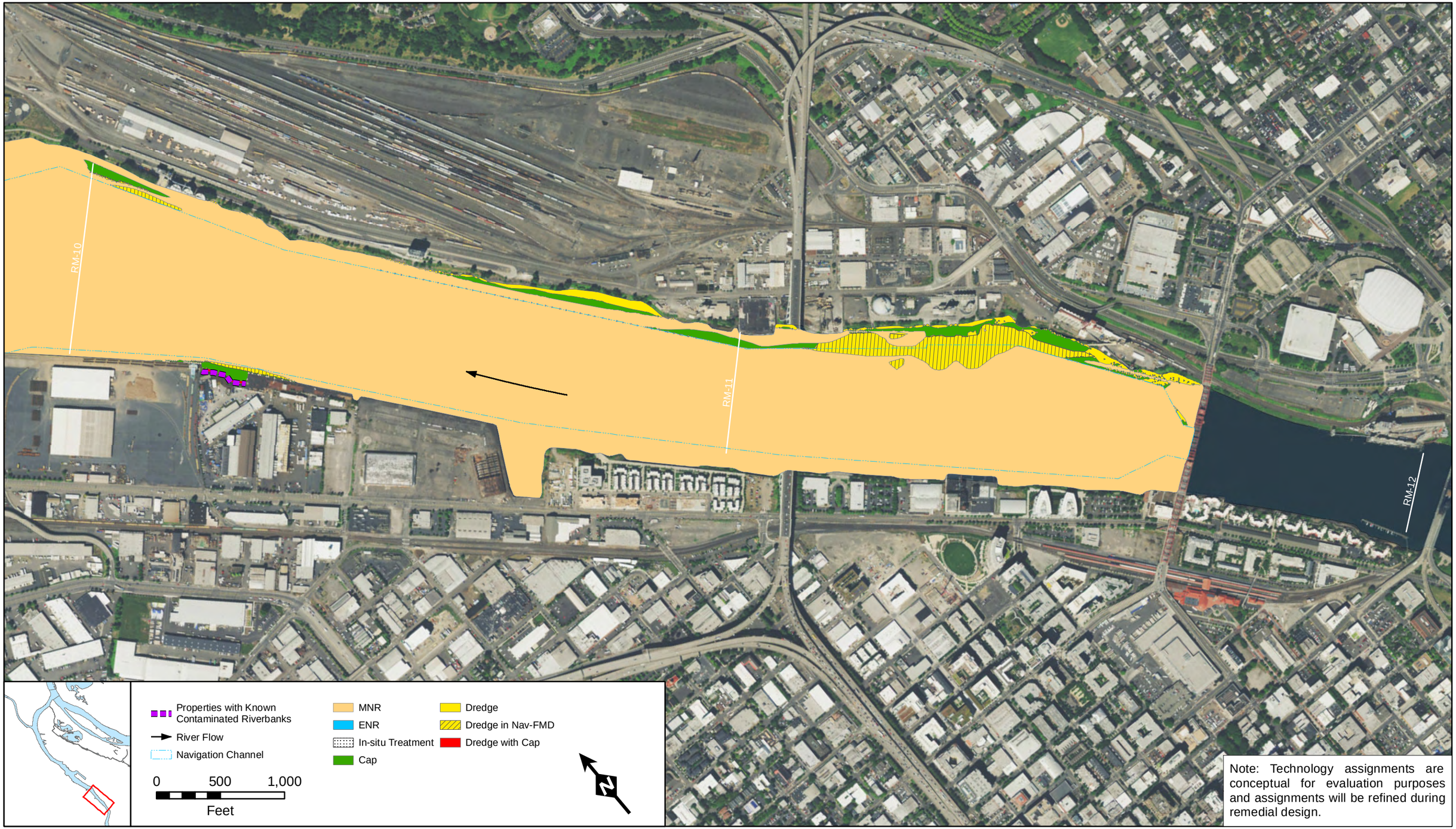
Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 30. Sediment Management Areas, Selected Remedy

Portland Harbor Superfund Site

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Record of Decision\FigX_SMA-AltFmod.mxd

Date: 10/21/2016



Note: Technology assignments are conceptual for evaluation purposes and assignments will be refined during remedial design.

Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 31e. Technology Assignments, Selected Remedy
River Mile 10 to 12
Portland Harbor Superfund Site

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\Record of Decision\Fig_Technology-Assignments-byAlt-RM.mxd, Created by: MLF

Date Saved: 10/12/2016 12:59:32 AM

completely absent (e.g., pre-design investigation, agency oversight, and Oregon Department of State Lands fees for access, leases, and easements).

Second, the FS fails to examine and compare the relative magnitude of cost to effectiveness of each alternative individually and the cost and effectiveness of alternatives in relation to one another. See NCP Preamble at 55 FR 8728.

EPA Position:
See EPA's position to LWG's dispute issue 2b.

The LWG has submitted many comments to EPA about deficiencies in the draft FS. Most of the deficiencies remain unaddressed. Issues associated with the evaluation of shortterm effectiveness, cost, and time are among significant concerns. However, just these concerns alone demonstrate a substantial weakness in the required evaluations in the FS and significantly impair any representation by EPA in the FS that the preferred alternative represents the best balance of the cleanup evaluation criteria.

Union Pacific disputes that EPA's evaluation of short-term impacts, cost-effectiveness, and time for construction of the cleanup are reasonable and in accordance with the NCP.

EPA Position:
EPA considered all the issues previously raised by the LWG, and addressed all the issues raised by the LWG that needed to be addressed. Although the LWG may not agree with EPA's final decision on a particular issue does not mean that EPA did not address their issues.

UPRR Dispute Issue 6 - Sediments Near Albina Yard Do Not Require Cleanup
The FS preferred alternative identifies two areas of sediments between RM 10 and 11 that EPA has identified for cleanup, purportedly due to exceedances of the PCB remedial action level ("RAL"). EPA also identified these areas on Figure 3.2-3 as containing principal threat waste. This area of the Site is near Union Pacific's railyard at Albina Yard. Union Pacific disputes this determination, particularly the area from approximately RM 10.7 to RM 11 where there are no exceedances of the applicable RAL in surface or subsurface samples of sediments.

EPA's potential cleanup area near RM 10.7 appears to be based on a PCB exceedance in soil at one location on a 900-foot stretch of the riverbank. EPA included riverbanks as part of its draft FS evaluation of alternatives, but did not identify Albina Yard as a site with "known contaminated riverbank" in section 1.2.3.5 of the FS.

Moreover, in its Final Remedial Investigation/Source Control Measures Evaluation Report for Albina Yard dated November 2010, which was reviewed and approved by Oregon DEQ, Union Pacific determined that the riverbank near Albina Yard had a low potential for erosion because it was highly vegetated and stabilized with rock/rip rap. Because PCB concentrations in the sediments are below the applicable RAL, and the

riverbank is stable, this area of sediments should not be included as a potential cleanup area. Certainly, the FS contains no explanation for this area's inclusion as a potential cleanup area, much less as an area containing principal threat waste.

Union Pacific disputes the apparent determination that sediments near RM 10.7 require remediation and, for the reasons explained in detail in section 4 above, the designation of such sediments as principal threat waste.

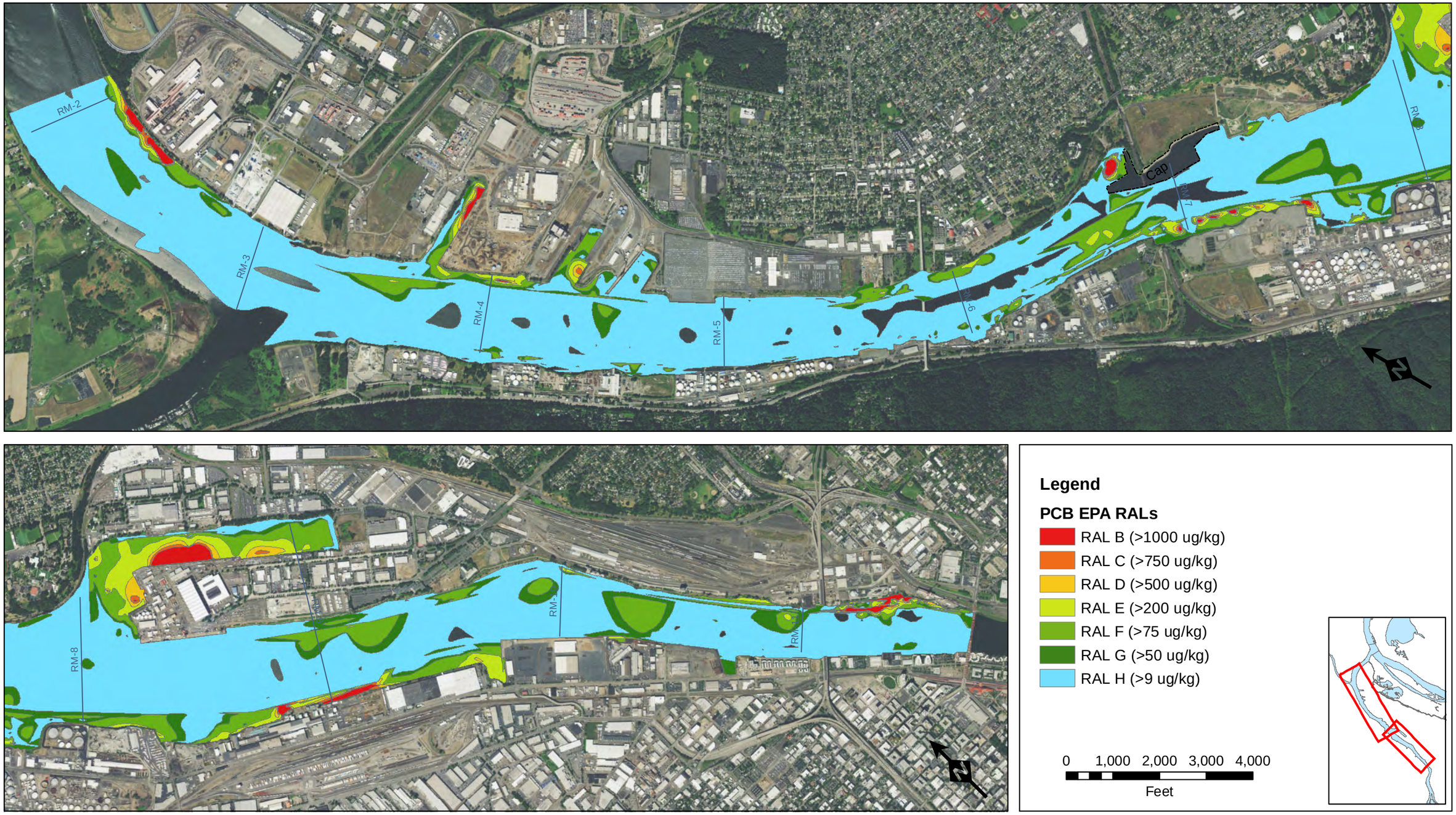
EPA Position:
The 2016 FS does not identify a preferred alternative. Further, EPA only developed SMAs based on extrapolations of existing sediment data that exceeded RALs, not river bank data. As Respondents point out, the river bank at Albina is not listed as contaminated. The SMA Respondent refers to is an artifact of the computer interpolation process, like many of the other small areas on the site. Because boundaries were not used in the computer interpolation process, this SMA is actually based on the high concentration sample data upstream from that location. EPA confirmed that there are not currently any samples in this cove that exceed RALs until more instream away from the shore at the Alternative H level, which is why there is an SMA strip outside the cove. The 2016 FS is not a design document and the footprints of the SMAs are based on extrapolations of RI/FS data, not design level data, and should not be used as absolute boundaries for SMAs. They are merely to identify at this stage of the process the cost estimates of remedial technologies to be used at the site in order to conduct a comparative analysis. Sampling conducted in remedial design will determine the boundaries for SMAs for active remediation.

UPRR Dispute Conclusion
Sediment megasites like the Portland Harbor Site are extremely challenging -challenging to characterize the contamination and the dynamics of the river system, challenging to identify what are the significant risks, and challenging to evaluate alternatives to reduce such risks. Union Pacific appreciates the hard work, resources, and dedication EPA has devoted to the Site prior to and since the Site was added to the National Priorities List in 2000.

Nonetheless, Union Pacific is concerned that because EPA's FS does not comply in significant ways with regulatory requirements and guidance recommendations for sediment megasites, EPA's description of a preferred alternative is not realistic and will not achieve protection of human health and the environment for a reasonable cost and within a reasonable time frame. Union Pacific looks forward to further communication with EPA as its dispute of the FS is considered by EPA.

EPA Position:
EPA has responded to the specific issues raised by Union Pacific. The 2016 FS was developed with EPA's experts at headquarters and reflects feedback and the support provided overall on the content and analysis contained in the 2016 FS, as well as recommendations made by EPA's expert panels for CERCLA remedies and sediment

sites (NRRB and CSTAG). Union Pacific has not provided any specific or credible evidence to support that the FS does not comply with the NCP and EPA guidance.

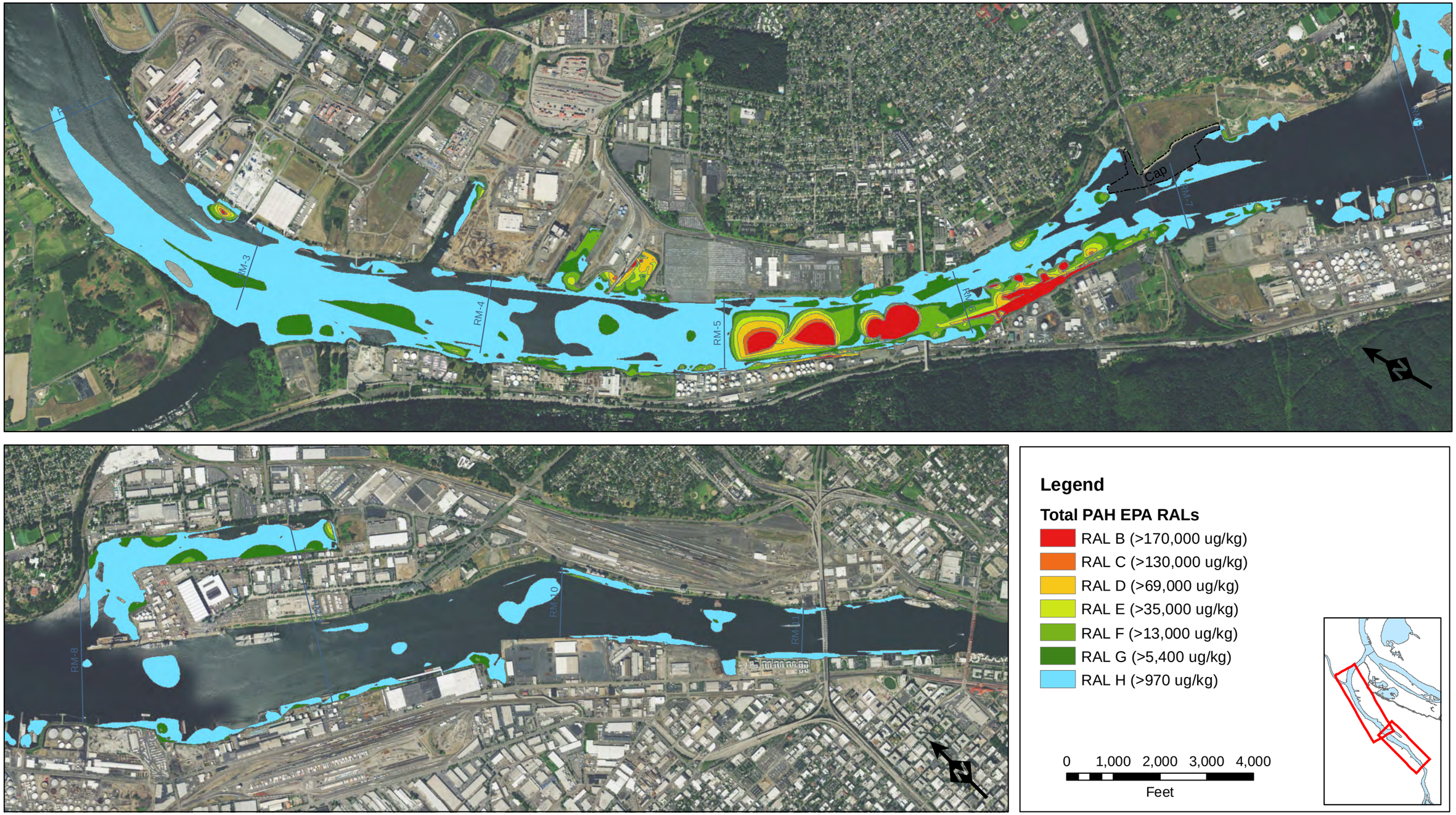


Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-7. PCB RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-03-07_Total-PCB-RALs.mxd

Date: 3/29/2016



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-8. Total PAH RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-03-08_Total-PAH-RALs.mxd

Date: 3/29/2016

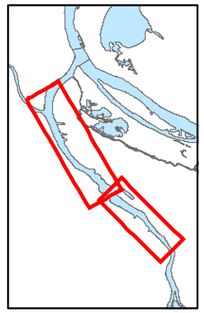
Legend

2,3,7,8-TCDD RALs

- RALs B, C, D (>0.002 ug/kg)
- RALs E, F, G (>0.0006 ug/kg)
- RAL H (>0.0002 ug/kg)

0 1,000 2,000 3,000 4,000

Feet

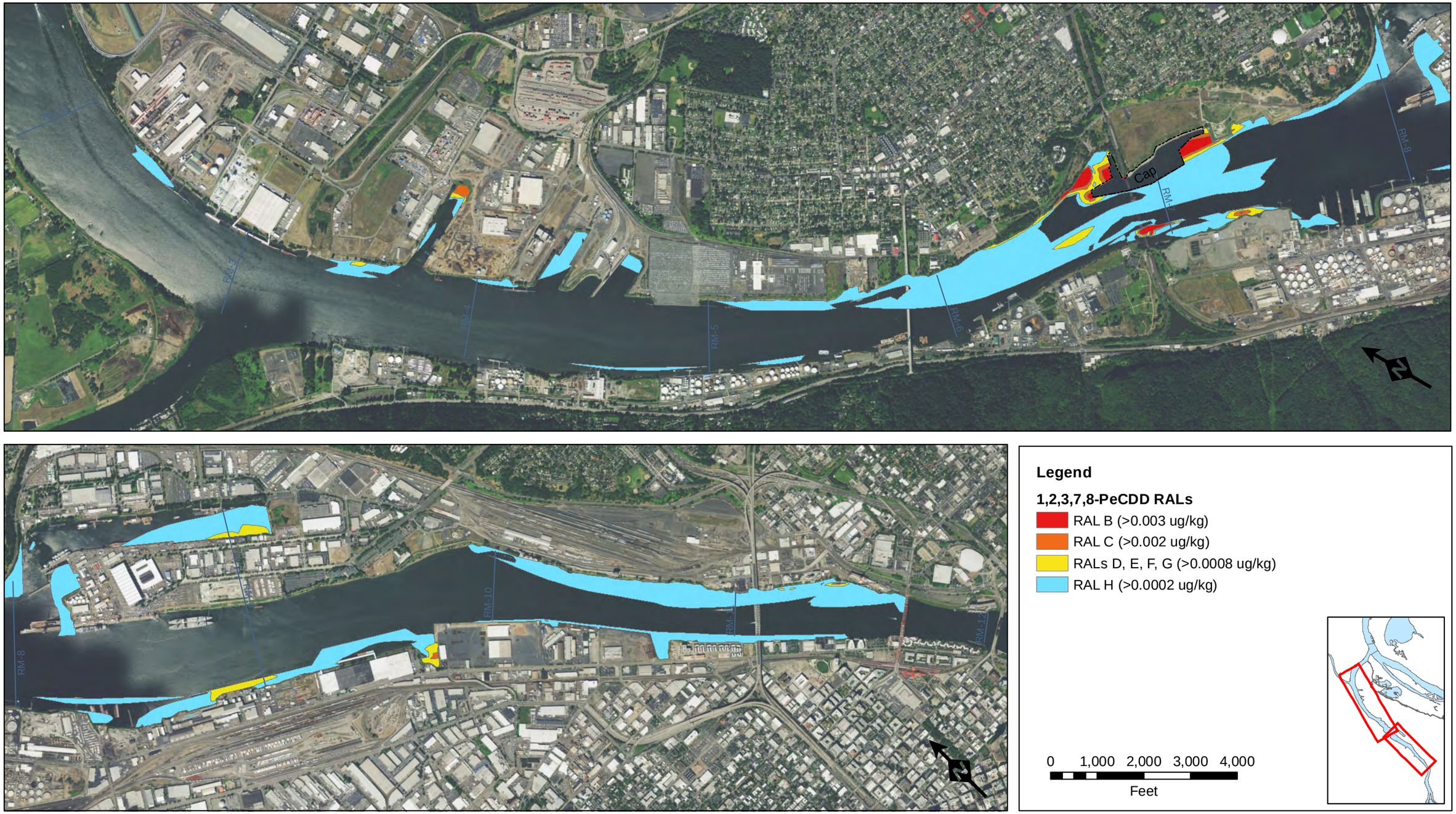


Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-9. 2,3,7,8-TCDD RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-04-09_TCDD-RALs.mxd

Date: 4/19/2016

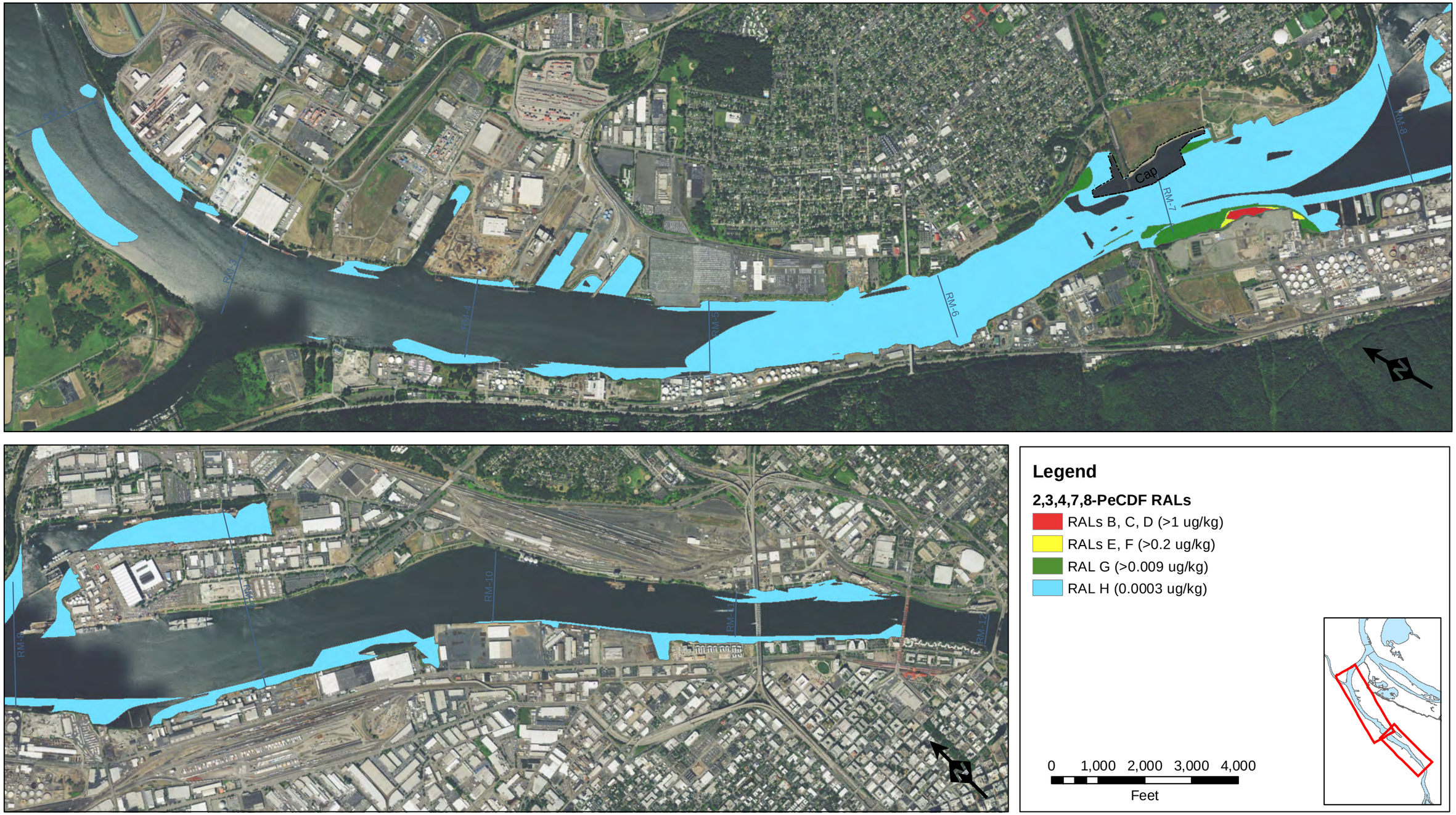


Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-10. 1,2,3,7,8-PeCDD RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-04-10_PeCDD-RALs.mxd

Date: 4/19/2016

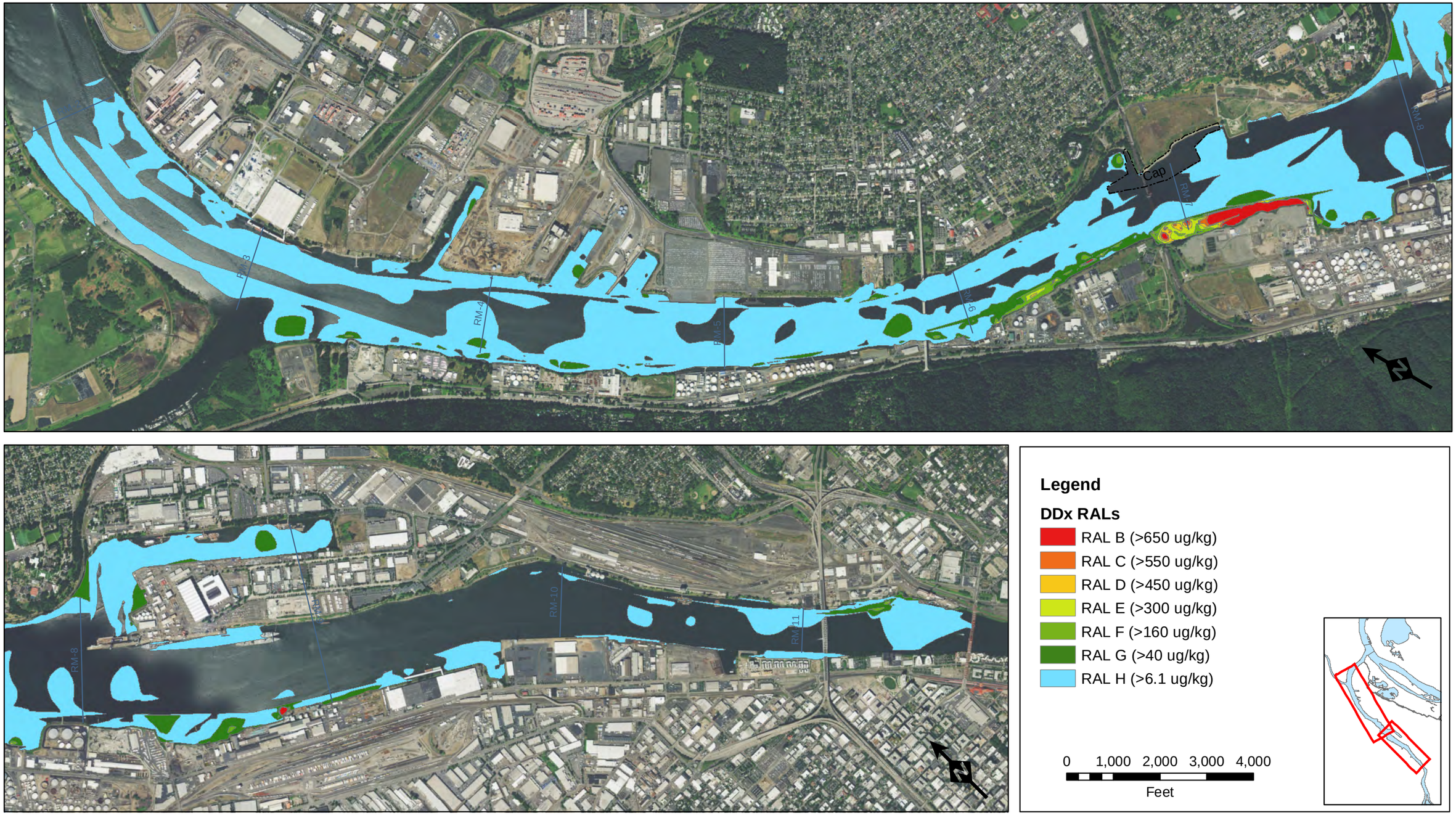


Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-11. 2,3,4,7,8-PeCDF RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-04-11_PeCDF-RALs.mxd

Date: 4/19/2016



Source Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 3.4-12. DDx RAL Contours

Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-03-12_Total-DDX-RALs.mxd

Date: 3/29/2016

This page intentionally left blank.

ATTACHMENT 2

RM11E DDx Evaluation Technical Memorandum

This page intentionally left blank.

GSI Water Solutions, Inc.

TECHNICAL MEMORANDUM

RM11E DDx Evaluation

To: Hunter Young, EPA Region 10

From: Dave Livesay, R.G.
Alison Clements

Date: February 20, 2020

Introduction

The RM11E Group prepared a draft Sampling and Analysis Plan (SAP) for Phase I Remedial Design Sampling which was submitted to EPA on December 20, 2019. The SAP proposed a list of chemicals of concern (COCs) for laboratory analysis that drive the need for remedial action based on the extensive work completed to date in the RM11E Project Area. These 'driving' COCs are proposed for sediment management area (SMA) refinement and depth of contamination (DOC) determination, and consist of Total PCBs (Aroclors) and dioxin/furan congeners excluding Table 21 COCs Total PAHs and DDx presented in the Portland Harbor Record of Decision (ROD) (EPA, 2017).

In reviewing the draft SAP, EPA has agreed with the elimination of total PAHs as a driving COC because the single RAL exceedance was in a shoreline soil sample (mapped as sediment) and the sample was bounded by 'clean' samples with concentrations well below the total PAH RAL as revised by EPA in the Explanation of Significant Differences (ESD) (EPA, 2019).

In an email from EPA (February 12, 2020), it was requested that the RM11E group provide further technical evaluation to support the elimination of DDx as a driving COC. The requested DDx evaluation is presented in the following sections.

Background

In 2009, surface and subsurface sediment samples were collected in the RM11E Project Area by the City of Portland. Samples were submitted for laboratory analysis and were archived pending evaluation of the laboratory results. Pesticides were analyzed by the 'conventional' pesticide method performed by gas chromatography/electron capture detection (GC/ECD), using SW-846 Method 8081A (EPA 8081A). Following receipt of laboratory results, it was noted that apparent elevated pesticides in sediment were associated with samples that also had elevated concentrations of Total PCBs. To evaluate possible matrix interference effects from PCBs, a subset of 12 archived sediment samples were selected for follow-up analyses using a high resolution gas chromatography/tandem mass spectrometry (GC/MS/MS) method (EPA 1699M).

In addition to the reanalysis of 12 archived samples, high resolution analysis was also run on samples collected in later studies. In 2013, the RM11E Group conducted high resolution analysis on six surface sediment samples (RM11E-G076,-G077, -G079, -G082, -G082, -G084) as part of the Supplemental RI/FS. In 2018, twelve 3-point composite surface sediment samples were collected by the PreRD Group from the RM11E Project Area and analyzed using the high resolution method.

Comparison of Conventional and High Resolution Methods

The RM11E Supplemental Data Report (GSI, 2013), presents the results from the EPA 1699M, high resolution, archived sample analysis and compares those results to those produced using EPA 8081A (conventional). These findings are presented in Table 1 along with the percent reduction in concentration using the high resolution method.

Table 1 – Comparison of Conventional and High Resolution DDx Results.

Sample ID	TOTAL DDx (µg/kg)				
	Conventional Result	Qualifier	High-Resolution Result	Qualifier	Percent Reduction
RM11E-C003-D	63	T	56.36	T	11%
RM11E-C003-B	56.2	JT	42.75	JT	24%
RM11E-C023-E	34.5	JT	29.16	T	15%
RM11E-C019-D	230	T	25.35	JT	89%
RM11E-C022-C	81.6	JT	18.83	T	77%
RM11E-G026	17	T	8.15	JT	52%
RM11E-G036	179	T	3.77	JT	98%
RM11E-G023	118	T	0.87	JT	99%
RM11E-C047-B	6.3	T	0.87	JT	86%
RM11E-G033	13	T	0.424	JT	97%
ST003-Q3	14	T	2.84	JT	80%
ST003-Q4	20.35	JT	7.453	JT	63%

Notes:

Sample code designations: C0: cores, G0: surface grabs, ST0: sediment trap solids.

J – Estimated concentration above the method detection limit and below the method reporting limit.

T – A summed total of individual isomers of DDD, DDE, and DDT.

This table illustrates that all samples results by conventional method (EPA 8081A) exhibit a reduction in concentration when the companion archived sample was run using the high resolution method (EPA 1699M). While the percent reduction is variable, the results verify that analytical bias does occur and that the more reliable high resolution method should be used for pesticide analysis in the RM11E Project Area.

Evaluation of Comprehensive DDx Results

The complete RM11E DDx data set for surface and subsurface sediments (96 sample results) is presented in Table 2, sorted from highest to lowest concentration. Along with 69 conventional sediment test results, these data include the 27 high resolution sediment test results collected by RM11E Group (sample prefix RM11E-) and the Pre-RD Group (sample prefix PDI-). The high resolution results for the reanalyzed archived samples shown in Table 1 were substituted into Table 2 in lieu of the prior conventional results. The data in Table 2 summed totals using the Portland Harbor Feasibility Study summation rules. No analytical bias correction factor was applied to the conventional results shown in Table 2. A map showing the distribution of these data in the RM11E project area is presented in Figure 1. The results show the following:

- The five highest concentrations are from older Lower Willamette Group (LWG) samples analyzed using the conventional laboratory method. Of these, only one surface sediment sample (LW3-GCA11E-C00 at 457 µg/kg DDx) had a conventional testing result that exceeded the applicable near shore DDx RAL of 160 µg/kg. As shown in Figure 2, this sample location is within the RM11E SMA footprint which is primarily driven by Total PCB RAL exceedances. This area will be investigated under the Phase I SAP and is subject to subsequent remediation.

- The second highest concentration, surface sediment sample LW3-UG02 (261 µg/kg DDx), is located in the navigation channel and does not exceed the navigation channel DDx RAL of 650 µg/kg established in the ROD.
- Of 96 test results, only 1 sample (1%) exceeds the RAL and this was tested by conventional methods and therefore the result is likely biased high. The remaining 95 samples (99%), tested by conventional or high resolution methods, were all below the RAL.
- Except for the five highest concentrations (from the LWG conventional testing), the remaining 91 sample results (95%) are at concentrations less than one-half of the RAL. And 87 results (91%) of the tabulated test results are less than one-third of the RAL.

This consistency in concentrations demonstrates that DDx is not a driving COC in the RM11E Project Area. This finding is further confirmed by the recent 2018 high resolution results by the Pre-RD Group which were all well below RALs.

Conclusions and Recommendations

- Based on the historical sediment analytical results at RM11E, it is concluded that DDx is not a driving COC in this area and it is appropriate to drop this Table 21 focused COC from the analytical list during the Phase 1 RD SAP and future remedial design.
- To gain an updated and accurate DDx concentration in surface sediment at LW3-GCA11E-C00 (historical location where the conventional laboratory result exceeded the RAL), it is recommended that this station be re-occupied, and a surface sample collected using the 3-point composite approach consistent with other surface grab samples in the Phase I RD SAP. The sample would be run for pesticides using the high resolution method (EPA 1699M).

References

EPA, 2017. Record of Decision for the Portland Harbor Superfund Site, Portland, Oregon. January 3, 2017.

EPA, 2019. Explanation of Significant Differences, Portland Harbor Superfund Site - Portland, Oregon. December 9, 2019.

GSI 2013. River Mile 11 East Supplemental Data Report - Archived Bank Soil and Sediment Re-Analysis. Prepared for City of Portland Bureau of Environmental Services. April 2013.

Table 2. Summary of Conventional and High Resolution DDx Results in RM11E Project Area.

SAMPLE ID	DDx (ug/kg)	METHOD
LW3-GCA11E-C00	457.29	Conventional
LW3-UG02	260.95[a]	Conventional
LW3-G778	151.90	Conventional
LW3-UC01-B	143.60	Conventional
LW3-UC03-B	119.90	Conventional
RM11E_BDSL015	70.85	Conventional
LW3-GCRSP11E	69.26	Conventional
LW3-G776	59.77	Conventional
RM11E-C003-D	56.36	High Resolution
RM11E-G015	52.91	Conventional
RM11E-C003-B	42.75	High Resolution
RM11E-C012-B	33.10	Conventional
RM11E-G029	30.80	Conventional
RM11E-C023-E	29.16	High Resolution
LW3-UG03	25.72	Conventional
RM11E-G066	25.40	Conventional
RM11E-C019-D	25.35	High Resolution
WLR0797WRCD40RCD40A	24.00	Conventional
RM11E-G028	23.13	Conventional
WLCT0I98ISC1ISC1	20.00	Conventional
WLCDRD05PG06363	18.96	Conventional
RM11E-C022-C	18.83	High Resolution
LW3-UC03-C	18.64	Conventional
LW3-UG01	17.75	Conventional
LW3-G779	17.24	Conventional
RM11E-G022	15.89	Conventional
WLCGWF03GNCOMP2003	14.62	Conventional
RM11E-C048-C (R1)	14.45	Conventional
RM11E-C015-B	12.33	Conventional
LW3-G771	12.27	Conventional
RM11E_BDSL004	11.95	Conventional
RM11E_BDSL017	11.82	Conventional
RM11E-G067	11.40	Conventional
LW3-UC03-D	11.34	Conventional
RM11E-C020-B	10.30	Conventional
RM11E-G084	9.79	High Resolution
LW2-G516	9.00	Conventional
PDI-SG-B389-BL1	8.30	High Resolution
RM11E-G026	8.15	High Resolution
RM11E-C009-B	7.34	Conventional
PDI-SG-B405-BL1	7.25	High Resolution
PDI-SG-B392-BL1	6.42	High Resolution
RM11E-G027	6.40	Conventional
PDI-SG-B404-BL1	5.90	High Resolution
PDI-SG-B398-BL1	5.21	High Resolution
RM11E-G024	4.68	Conventional
RM11E-G018	4.00	Conventional
RM11E-G036	3.77	High Resolution

SAMPLE ID	DDx (ug/kg)	METHOD
PDI-SG-B400-BL1	3.68	High Resolution
RM11E-C010-A (R2)	3.58	Conventional
PDI-SG-B386-BL1	3.51	High Resolution
LW3-C779-B	3.37	Conventional
PDI-SG-B410-BL1	2.95	High Resolution
RM11E-G068	2.74	Conventional
RM11E-G076	2.59	High Resolution
RM11E-G012	2.50	Conventional
RM11E-G005	2.43	Conventional
WLCCIF01T03T03	2.42	Conventional
RM11E-G008	2.31	Conventional
WLCCIF01T04T04	2.20	Conventional
RM11E-G082	2.17	High Resolution
RM11E-G039	2.07	Conventional
WLCT0I98ISC2ISC2	2.00	Conventional
RM11E-G043	2.00	Conventional
RM11E-C006-B	1.94	Conventional
RM11E-G021	1.85	Conventional
PDI-SG-B408-BL1	1.60	High Resolution
PDI-SG-B391-BL1	1.40	High Resolution
WLCCIF01020304020304	1.40	Conventional
RM11E-C025-B	1.30	Conventional
WLCCIF01T01T01	1.10	Conventional
PDI-SG-B396-BL1	0.94	High Resolution
PDI-SG-B399-BL1	0.94	High Resolution
RM11E-C047-B	0.87	High Resolution
RM11E-G023	0.87	High Resolution
LW3-G777	0.78	Conventional
WLCCIF01T02T02	0.73	Conventional
RM11E-G079	0.70	High Resolution
LW3-UC02-B	0.69	Conventional
RM11E-C038-B	0.68	Conventional
RM11E-G003	0.52	Conventional
RM11E-G033	0.42	High Resolution
RM11E-G077	0.39	High Resolution
LW3-UC02-C	0.27	Conventional
RM11E-C032-B	0.20	Conventional
LW3-C777-B	0.18	Conventional
LW3-C777-C	0.18	Conventional
LW3-C777-D	0.18	Conventional
LW3-C778-B	0.18	Conventional
LW3-C778-C	0.18	Conventional
LW3-C779-C	0.18	Conventional
LW3-C779-E	0.18	Conventional
RM11E-C021-B	0.10	Conventional
RM11E-C024-B	0.10	Conventional
RM11E-C029-B	0.10	Conventional
RM11E-C035-C	0.10	Conventional

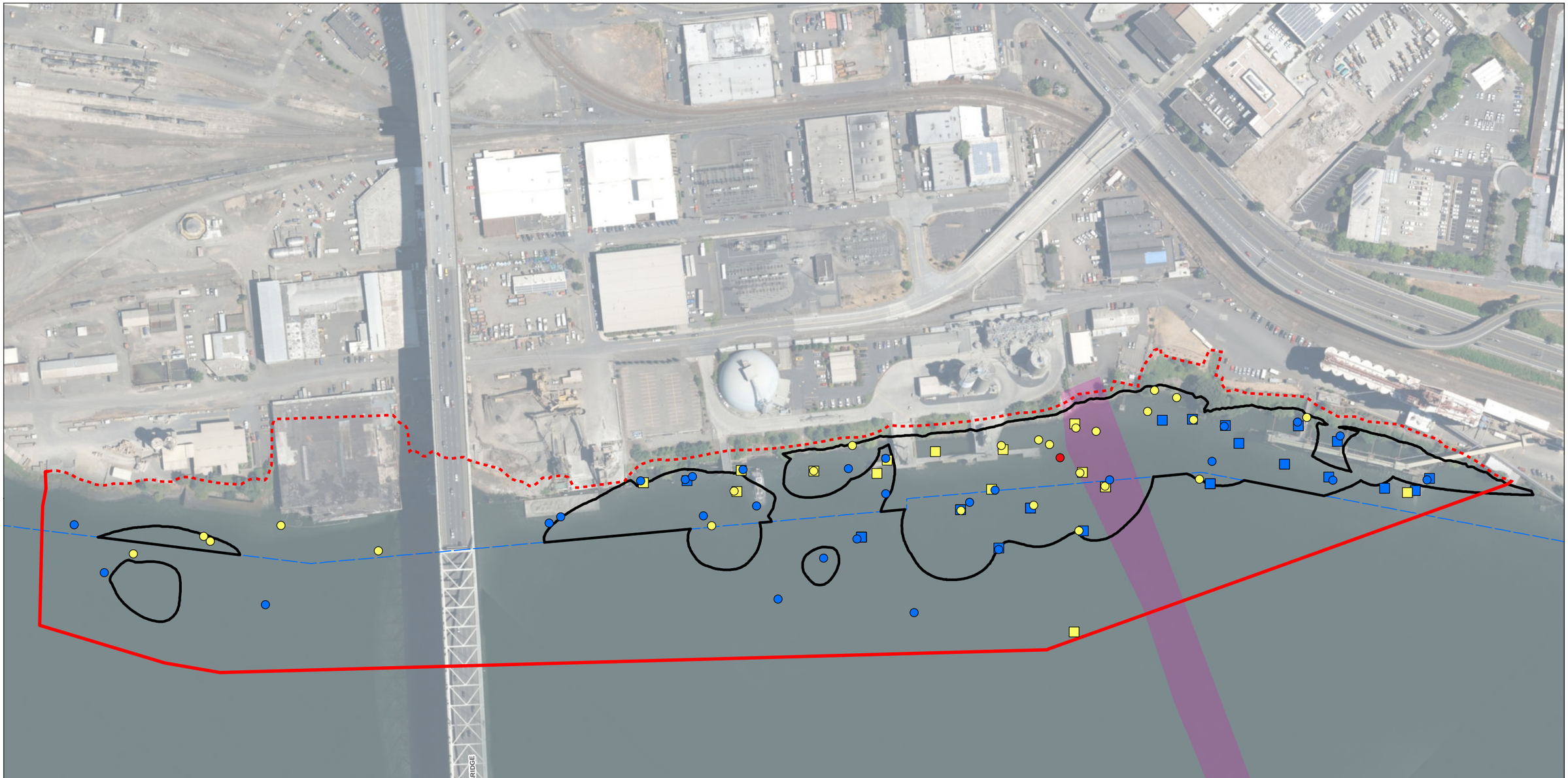
Notes:

[a] Sample is in the Navigation Channel (no RAL exceedance).

DDx Nearshore RAL =160 ug/kg

DDx Navigation Channel RAL=650 ug/kg

Sample code designations: C0: cores, G0: surface grabs



LEGEND

Sediment and Soil Samples
- Surface Sediment
- Subsurface Sediment

Nearshore DDx Concentration (ug/kg)
- 160 - 650
- 6.1 - 160
- 0 - 6.1

Navigation Channel DDx Concentration (ug/kg)
- >650
- 6.1 - 650
- 0 - 6.1

All Other Features
- RM11E Project Area (dashed indicates inferred top of bank)
- Sediment Management Area[1]
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel

1. The SMA footprints were delineated in the BODR using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

Date: February 19, 2020
Data Sources: USACE, METRO, DEA

FIGURE 1

Total DDx Surface/Subsurface Not Corrected for Analytical Bias Results

River Mile 11 East
Willamette River
Portland, Oregon

N

0 80 160 240
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\DDx_Submittal\Figure1_TotalDDx_Conv_Surface_SubSurface_Results.mxd

LEGEND

- RAL Exceedance Location
- Proposed Subsurface Sampling Location
- Sample Area

All Other Features

- RM11E Project Area (dashed indicates inferred top of bank)
- Historical Subsurface Sediment Sample
- Sediment Management Area[1]
- Cable Crossing Caution Zone
- U.S. Army Corps of Engineers Navigation Channel
- Anchored Soldier Pile Retaining Wall
- Cantilevered Soldier Pile Wall
- Bulkhead Wall
- 5' Elevation Contour
- Building/Structure

1. The SMA footprints were delineated in the BODR using the natural neighbor interpolations (in ArcGIS) of surface sediment concentrations in a manner consistent with that used by the Lower Willamette Group in the Draft FS for the Portland Harbor.

Date: February 19, 2020
Data Sources: USACE, METRO, DEA

FIGURE 2

Proposed Subsurface Sediment Sampling Stations

River Mile 11 East
Willamette River
Portland, Oregon

N

0 80 160 240
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\DDx_Submittal\Figure2_Proposed_Subsurface_Sed_Sampling_Overview.mxd

ATTACHMENT 3

Field Forms

This page intentionally left blank.

FIELD CHANGE REQUEST (FCR) FORM
GSI Water Solutions, Inc.

Project Name: **River Mile 11 East, Phase I Remedial Design Sediment Sampling and Analysis Plan**

FCR Number: _____ **FCR Date:** _____

Prepared for: **Hunter Young, EPA**

Summary:

_____

_____

Description of Proposed Modification:

_____

_____

Reasons for Modification:

_____

_____

_____

_____

_____

Schedule Impacts:

_____

_____

Submitted by:

Project Manager: _____ Date:_____

Approved by:

EPA Representative: _____ Date:_____

GSI Water Solutions, Inc.

Project Name:	Project Number:	Project Location:	Core Station ID Number:

SURFACE SEDIMENT SAMPLING DATA SHEET

Weather Conditions:		**Sampling Personnel:**	
Depth Sounding Method:		**Sampling Equipment:**	
Target Coordinates (NAD 83):	Easting:	**Gauge Source:**	
	Northing:	**Gauge Height (ft)/Time:**	
Tide:		**Gauge Datum** (circle)**:**	PRD CRD NAVD88

EPA Oversight During Collection? Yes No **If Yes, Name of Person:** _____

SAMPLE INFORMATION

Sample ID	Time	Type (Primary, Duplicate, MS/MSD, EPA Split)	# of Containers
		Primary	

ATTEMPT SUMMARY

Attempt #	Time	Coordinates		Water Depth (ft)	Recovery Depth (cm)	JC? ✓	OLW? ✓	Accepted? ✓	Photo? ✓	Notes	Sample Interval (cm)
		Easting	Northing								

Definitions: Rec. = recovery; JC = jaws closed; OLW = overlying water

Additional Comments: (e.g., colocated samples, composite, revisit station, access issues, NAPL suspected, target depth issues)

ATTEMPT 1 DESCRIPTION		
Moisture:	**Density:**	**Color:**
Size Characterization (%G/S/F):	**Odor/Sheen:**	
Structure:		
Organics, Biota, or Other:		

ATTEMPT 2 DESCRIPTION		
Moisture:	**Density:**	**Color:**
Size Characterization (%G/S/F):	**Odor/Sheen:**	
Structure:		
Organics, Biota, or Other:		

ATTEMPT 3 DESCRIPTION		
Moisture:	**Density:**	**Color:**
Size Characterization (%G/S/F):	**Odor/Sheen:**	
Structure:		
Organics, Biota, or Other:		

SEDIMENT CORE PROCESSING LOG

Project Name:	**Core ID:**
Project Number:	**Attempt #:**
Core Logger:	**Date and Time:**

Core Information	**Incremental Acquisition Data**		
Collection Method:	**Drive Length (ft)**	**Acquired (ft)**	**Recovery (%)**
Mudline Elevation (ft NAVD 88):			
Northing (NAD 83):			
Easting (NAD 83):			
Total Drive Length (ft):			
Total Recovery (ft):			
Total Recovery (%):			

Depth (ft)	**Grain Size Distribution**			**Lithology**	**SOIL/SEDIMENT DESCRIPTION**	**Samples**
	%G	**%S**	**%F**		**USCS Group Name (USCS Group Symbol):** color, moisture, mineralogy, density, structure, cementation, staining/sheen/odor. Coarse Fraction: grain size, angularity, hardness, shape. Fine Fraction: plasticity, dry strength, toughness, dilatency. Add additional comments.	

Notes:

Page Number:
___ of ____

SEDIMENT CORE COLLECTION FORM

Project:	**Core ID:**	**Accepted (Y/N):**
Project #:	**Attempt #:**	**Date and Time:**

Deployment Data

Northing:	**Water Depth (ft):**	**Gauge Height (ft NAVD 88):**	**Mudline Elevation (ft NAVD 88):**
Easting:	**Time:**	**Time:**	
	Method:	**Gauge Location:**	

Incremental Acquisition Data

Drive Length (ft)	Acquired Length (ft)	Incremental Recovery (%)	Cumulative Recovery (%)	Drive Notes

Accepted Core Processing Information

Core Tube Length (ft):	**Headspace (ft):**	**Section: Start - End Depths (ft bml)**	**Length (ft)**
Total Penetration (ft):	**Shoe Loss (ft):**	**A =**	
Total Recovery After Drive (ft):	**Length of Core to Process (ft):**	**B =**	
Total Recovery After Retrieval (ft):		**C =**	
Total Recovery After Retrieval (%):		**D =**	
		E =	

Core Observations and Notes

USCS Group Name (USCS Group Symbol): color, moisture, mineralogy, density, structure, cementation, staining/sheen/odor. Coarse Fraction: grain size, angularity, hardness, shape. Fine Fraction: plasticity, dry strength, toughness, dilatency. Add additional comments.

bml: below mudline

ATTACHMENT 4

Cascade Drilling Memorandum, Using V-Sampler for 11 Mile Overwater Investigation on the Willamette River in Portland, Oregon

This page intentionally left blank.

CASCADE
DRILLING | TECHNICAL SERVICES

David Livesay
Ground Water Solutions, Inc.
55 SW Yamhill St, Suite 400
Portland, OR 97204
O: 503-239-8799
Email: dlivesay@gsiws.com

September 16, 2019

RE: RFP Using V – Sampler for 11 Mile Overwater Investigation on the Willamette River in Portland, OR

Dear Mr. David Livesay,

Thank you for the opportunity to provide you with a proposal for the above referenced project. Due to our support staff, experienced drillers and numerous drill rigs, based in the Northwest, CDLP can complete technically challenging overwater projects. CDLP can provide a large range of casing size and sampling equipment required execute this project, we have previously performed drilling services at similar overwater sites, which produced excellent results. Collecting soft sediment samples is particularly difficult; we recommend that we use a custom CDLP adapted sampling system to collect the sediment samples. CDLP calls it the V-Sampling system. This is how it works, see the figure for reference:

Parts of the system

1. Cascade will cut 3" aluminum tubes to 5-foot lengths. The tubes will then have four borings drilled in one end, in order to attach to a customized shelby tube sub.
2. The shelby tube sub will have a hole bored through the top of the sub to bottom of the sub; this will allow a cable to pass through the sub into the center of the 3" aluminum tube.
3. A rubber cup will be adapted to accept an eye bolt, in order to connect the connecting cable.

Procedure

1. The cable is threaded through the port drilled through the shelby sub, and then will be strung through the 3"x5' aluminum tube.
2. The cable is then attached to the rubber seal at the eye bolt.
3. Push the seal into the bottom of the 3"x5-foot tube; the holes drilled in the tube indicates or "top" of the tube
4. The 3"x5-foot tube is then attached to the shelby sub using the bolt holes
5. The slack of the cable is pulled through the port in the sub, care needs to be taken not to pull the seal into the 3"x5-foot tube.
6. The sampler is then attached to drill rods, note the cable is on the outside of the drill rods and will have enough length to make it to land surface.
7. The sampler is then lowered to depth where the sample will be collected.
8. The connecting cable will be held at a fixed point, using a winch line.
9. The sampler will then be pushed to the desired depth or refusal. The cable holds the seal at a fixed elevation; the seal will ride up into the inside of the tube keeping the sample in place by suction (note - do not pull the cable using the connecting cable, this will disturb the sample).

10. At this point the drill rods and sampler are returned to land or the barge deck.
11. The bottom of the tube is capped using a 3" plastic cap.
12. The 3"x5-foot tube is disconnected from the shelby sub.
13. The location on the seal is measured from the top of 3"-5-foot tube.
14. A 3" Pipe cutter is then used to cut the 3"x5-foot tube, just below the position of the rubber seal.
15. The top of the sample tube is then capped, the tube needs to remain upright to prevent the sample from being disturbed.

Collecting the soft sediments is very difficult. Using the V-sampler has resulted in our highest rate of recovery in soft sediments and is why CDLP proposes using this method for the 11 Mile Willamette Project.

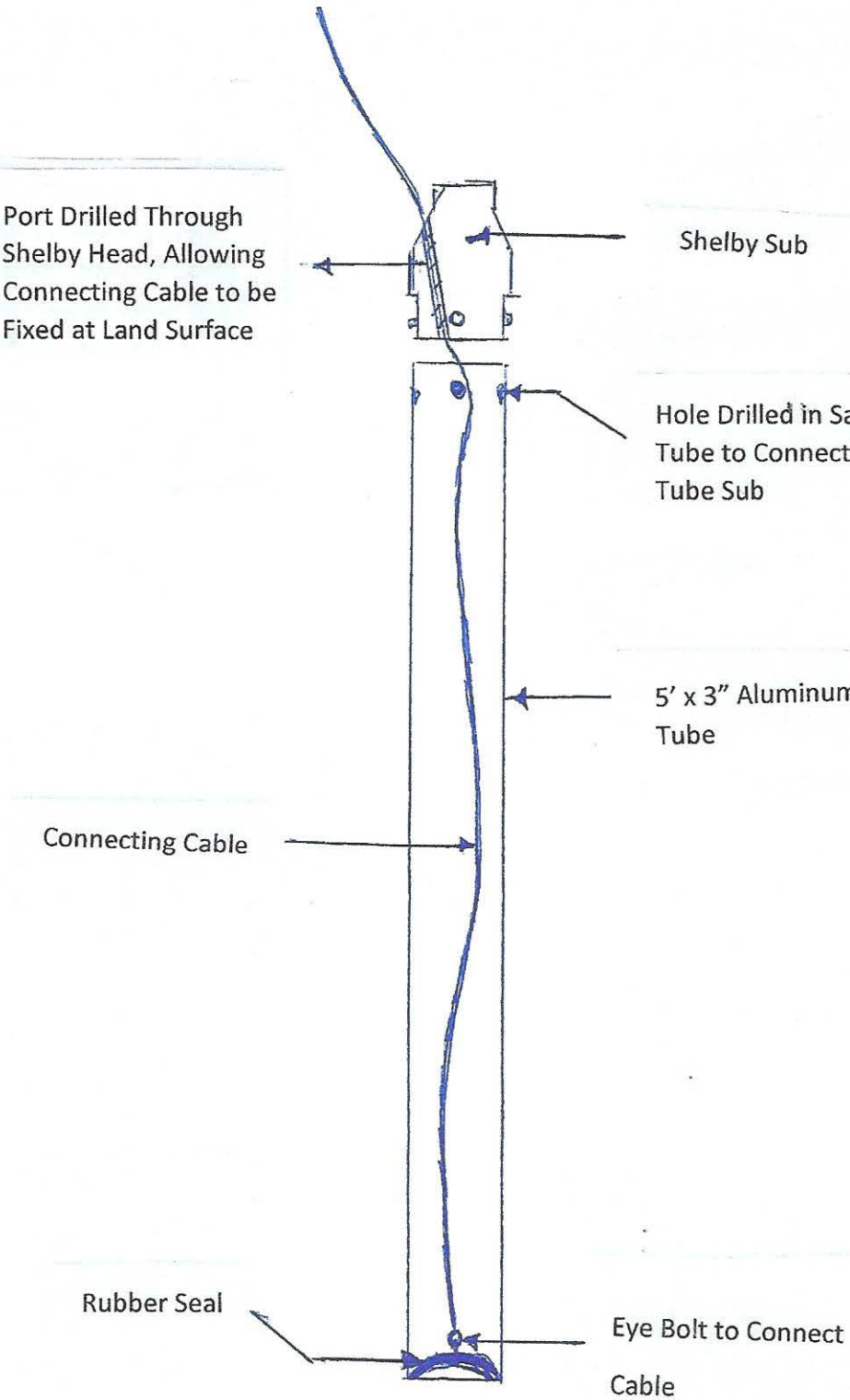
Sincerely,

Cascade Drilling L.P.

Trent Castner

Trent Castner
Northwest Estimating Manager
503-572-3090

V-Sampler


Port Drilled Through Shelby Head, Allowing Connecting Cable to be Fixed at Land Surface
Shelby Sub
Hole Drilled in Sample Tube to Connect to Shelby Tube Sub
5' x 3" Aluminum Sample Tube
Connecting Cable
Rubber Seal
Eye Bolt to Connect Cable

This page intentionally left blank.

ATTACHMENT 5

Plan and Procedures for the Inadvertent Discovery of Human Skeletal Remains and Cultural Resources

Page intentionally left blank.

Plan and Procedures for the Inadvertent Discovery of Human Skeletal Remains and Cultural Resources

RM11E Project Area, Portland, Oregon

The RM11E Participation Group plans to conduct surface and subsurface sediment sampling and riverbank soil sampling as part of the Supplemental Remedial Investigation and Feasibility Study (RI/FS). This work is being conducted pursuant to the Statement of Work (SOW) contained within the Administrative Settlement Agreement and Order on Consent (Settlement Agreement) (U.S. Environmental Protection Agency [EPA] Region 10, CERCLA Docket No. 10-2013-0087), Amendment No. 1. These investigations are supplementary to the RI/FS for the Portland Harbor Superfund Site and are targeted to facilitate selection and design of a final remedy at the RM11E Project Area.

The following Inadvertent Discovery Plan (IDP) outlines procedures to follow, in accordance with state and federal laws, if human remains or archaeological materials are discovered.

Introduction

Cultural resources are extremely important to our Tribal nations and to our state's sense of identity and history. Tribal cultural resources can include ceremonial artifacts and objects at burial sites. The locations of burials and their associated human remains are also of great importance to the traditions and identity of Tribes. Properties that contain cultural resources are of critical significance to Tribal nations. Therefore, it is extremely important that identification and protection of cultural resources be considered carefully in planning for any ground-disturbing activities at a site.

The *Cultural Resource Monitoring River Mile 11 East Focused Sediment Characterization, Willamette River, Portland, Multnomah County, Oregon* identified a moderate to high likelihood that archaeologically sensitive artifacts exist onsite (SWCA, 2010). Previous RM11E sediment investigations found numerous historic debris, which consisted of a mix of fragments including brick, nails, unknown metal, glass, ceramics, wood and plastic as well as recent anthropogenic debris mixed in with river sediments of sand, gravel, and silt. The debris appeared to be the result of a large amount of land-derived debris and fill pushed into the Willamette River channel during shoreline demolition events and historic structures at sites. No prehistoric archaeological materials or evidence of intact subsurface prehistoric cultural deposits were observed during the course of previous work.

This document provides guidelines should someone discover a cultural or archaeological resource onsite. It is important that workers onsite comply with applicable state and federal laws protecting these cultural resources.

Special Procedures for the Discovery of Human Skeletal Material

- If human remains or funerary objects are encountered, the Oregon State Police, Oregon State Historic Preservation Office (SHPO), and the appropriate tribes will be notified in accordance with Oregon state laws and regulations (Oregon Revised Statute [ORS] 97.740-97.760; State Executive Order Number 96-30). The Multnomah County Medical Examiner will also be notified if human remains are encountered.
    - If human remains are encountered, they should be treated with dignity and respect at all times. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection in place and to shield them from being photographed. Do not call 911 or speak with the media.

Recognizing Cultural Resources

A cultural resource discovery could be prehistoric or historic. Examples include:

- An accumulation of shell, burned rocks, or other food related materials
- Bones or small pieces of bone
- An area of charcoal or very dark stained soil with artifacts
- Stone tools or waste flakes (i.e. an arrowhead, or stone chips)
- Clusters of tin cans or bottles, logging or agricultural equipment that appear to be older than 50 years
- Buried railroad tracks, decking, or other industrial materials

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

Inadvertent Discovery Plan Procedures

Due to the potential to encounter archaeologically sensitive artifacts in the RM11E Project Area, David Ellis of Willamette Cultural Resources Associates, LTD (Willamette CRA) and his team will be retained to oversee potential cultural resources found on the Site during surface sediment sampling and groundwater monitoring well installation activities. A professional archaeologist from Willamette CRA will provide training to GSI Water Solutions, Inc. (GSI), field staff to define what kind of artifacts and deposits require examination and documentation by an archaeologist. This training would also address which materials and/or deposits are to receive less intensive documentation and the standards for minimal documentation. The archaeologist will also be present during the initial sampling to inspect surface sediment samples and soil cores and supplement the training, particularly when drilling in native soils, and will be on-call during the remainder of sampling activities.

If archaeologically sensitive prehistoric or historic artifacts are discovered when the archaeologist is not on site (i.e., on-call), the following steps will be taken:

STEP 1: STOP WORK. If any GSI employee, contractor or subcontractor believes that he or she has uncovered a cultural resource that requires examination by an archaeologist at any point in the project, all work adjacent to the discovery must stop.

STEP 2: NOTIFY MONITOR. The Field Director (GSI) will notify the project archeologist to examine the material in question. If the archeologist determines that the artifact(s) and/or deposits require formal documentation, they will follow the IDP procedures listed below and inform GSI staff when/if sampling activities may resume.

STEP 3: NOTIFY GSI PROJECT MANAGEMENT. If the project archeologist initiates the IDP procedures listed below, the Field Director (GSI) should notify the Project Manager (Dave Livesay) who will subsequently inform the RM11E Group of the status of such activities. If deemed appropriate by the project archeologist and the Project Manager, sampling activities may recommence in a different area of the Site while awaiting the results of the applicable IDP consultations.

The following presents specific IDP procedures for the RM11E site.

- If any previously unidentified archaeological materials are encountered by onsite staff or the onsite project archaeologist, all work at and adjacent to the discovery shall cease immediately. The project geologist or project archeologist will follow SHPO guidelines for known sites and isolated finds (ORS 358.905-385.955 or sites along scenic waterways (ORS 390.805-390.925).
- If isolated artifacts (designated by SHPO as less than 10 artifacts of non-diagnostic quality) are recovered sampling may continue.
- If a site of 10 or more artifacts or a feature is encountered during sampling, the sampling process will be halted at that individual sampling location and the SHPO will be consulted. No ground-disturbing activities will recommence at that individual sampling location until SHPO concurs with the site assessment and recommendation.
- If faunal (bone) material is observed in a grab sample and is clearly not fish or bird bone, the project archeologist immediately will contact a supervisory archaeologist with osteological training to determine whether the bone is human or animal. Work will be halted until the osteological determination has been made.

Documentation of Archaeological Materials

All historic artifacts collected from grab samples will be analyzed, catalogued and temporarily curated. Ultimate disposition of cultural materials will be determined in consultation with SHPO, or any other applicable tribes and agencies.

All archaeologically sensitive prehistoric or historic cultural material discovered during project construction will be recorded by a professional archaeologist on a form using standard techniques. Site overviews, features, and artifacts will be photographed; stratigraphic profiles

and soil/sediment descriptions will be prepared for subsurface exposures. Discovery locations will be documented on scaled site plans and site location maps.

Archaeological discoveries will be documented and reported to SHPO, other potential federal agencies, and any potentially affected tribe(s). If no cultural resources are encountered, the project archeologist will sign a compliance certification and summarize all observations for inclusion in the Field Sampling and Data Report.

Finds of incidental debris that do not warrant formal documentation will be provided to Willamette CRA for review and integration into the Field Sampling and Data Report.

Reference

SWCA Environmental Consultants, 2010. *Cultural Resource Monitoring Rive mile 11 East Focused Sediment Characterization Willamette River, Portland, Multnomah County, Oregon.* April 2010. Prepared for GSI Water Solutions, Inc.

Appendix A

GSI Site-Specific Health and Safety Plan

Phase I Remedial Design Sediment Sampling and Analysis Plan

River Mile 11 East

Portland, Oregon

May 2020

Prepared for

RM11E Group

Prepared by

GSI Water Solutions, Inc.

Page left blank intentionally.

In Case of Emergencies, Call 911. Always use an ambulance to go to the closest hospital for life-threatening injuries		
Emergency Contact	**Name**	**Phone Number**
Local Police	City of Portland Police Department	911 emergency 503-823-3333 (non-emergency)
Local Ambulance	American Medical Response	911 emergency
Local Fire Department	City of Portland Fire Department	911 emergency 503-823-3700 (non-emergency)
Local Hospital	Legacy Emanuel Hospital (2801 N Gantenbein Ave Portland, OR 97227)	503-413-2200 (emergency)
GSI Water Solutions, Inc. (GSI) Health and Safety Coordinator	Josh Bale	Office: 971-200-8502 Cell: 530-276-4188
Incident Intervention (WorkCare)	WorkCare	888-449-7787
Poison Control Center	—	1-800-222-1222
Oregon Emergency Response System *(to report a hazardous spill to the state agency)*	—	911 emergency 1-800-452-0311
National Response Center *(to report a hazardous spill)*	—	1-800-424-8802
State Reporting Agency *(Oregon Occupational Safety and Health [OSHA])*	—	1-800-321-6742 (Oregon)
GSI Field Investigation Project Director	Dave Livesay	Office: 971-200-8501 Cell: 541-868-5777
GSI Field Investigation Project Manager	Alison Clements	Office: 971-200-8528 Cell: 503-801-5565
Client Contact	Connor Lamb	Cell: 360-977-8056

STOP WORK AUTHORITY

All workers at the project site have "Stop Work Authority" to immediately stop work if they believe that a particular task is being performed in an unsafe manner. This authority may be exercised at any time by anyone working on the site without repercussions or retribution. If individuals observe hazards for which they are unprepared, they will withdraw from the area to reevaluate the task and develop appropriate safety precautions before proceeding. The GSI Health and Safety Coordinator will be contacted to determine next steps and this Health and Safety Plan (HSP) will be revised accordingly.

Contents

1. Introduction 1
2. Site Description 3
2.1 Description of Cargill Facility 3
2.2 Description of Glacier Facility 3
3. Directions to the Nearest Emergency Medical Facility 8
For Over-Water Work 8
For Upland Work 8
4. Emergency Procedures 10
5. Hazard Identification 12
6. Potential Chemical Hazards 16
6.1 Chemicals of Concern 16
6.2 Potential Chemical Exposure Pathways 16
7. Personnel Protection 17
7.1 Administrative Controls 17
7.1.1 Medical Monitoring 17
7.1.2 Periodic Comprehensive Exam 17
7.1.3 Medical Clearance Record Keeping 17
7.1.4 Training 17
7.2 Engineering Controls 18
7.2.1 Barriers and Signs 18
7.2.2 Work Zones 18
7.3 Personal Protective Equipment 19
7.3.1 Levels of Protection 19
7.3.2 PPE Failure/Chemical Exposure 19
7.3.3 PPE Inspection, Storage, and Maintenance 19
8. Decontamination Procedures 20
8.1 Personnel Decontamination 20
8.2 Equipment Decontamination 20
8.3 Emergency Decontamination 21
9. Disposal Procedures 22
10. Communications 23
10.1 Daily Tailgate Safety Meetings 23
10.2 Buddy System 23

11. Safe Work Practices 24
11.1 Accident Prevention 24
11.2 Personal Conduct 24
11.3 Work Limitations 24
11.4 Equipment and Activities 24
11.5 Noise Reduction 25
11.6 Sanitation 25
11.7 Illumination 25
11.8 Weather Conditions 26
12. Spill and/or Discharge of Hazardous Materials 27
12.1 Training 27
12.2 Spill Control and Response 27
12.3 Discharge Control and Response 27
12.4 Spill Response Reporting 27
12.5 Evacuation Procedures 28
13. Accident Reporting and Record Keeping 29
13.1 In Case of Emergency Injury or Illness 29
13.2 In Case of Non-Emergency Injury or Illness 29
13.3 In Case of Near-Miss Incident 29
13.4 Subcontractor Accident Reporting 29
13.5 GSI Accident Reporting to Client 29
14. References 30
15. Signatures 31
16. Limitations 32
17. GSI Safety Committee Members 33

Tables

Table 1. GSI Field Staff Members A-1
Table 2. Locations of Nearest Facilities A-7
Table 3. Safety Equipment A-10
Table 4. Hazard Identification A-12
Table 5. Training Requirements for Project A-17
Table 6. PPE to Be Used A-19
Table 7. Decontamination Equipment and Procedures A-20
Table 8. Emergency Hand and Horn Signals A-23
Table 9. Signatures for HSP A-31

Table 10. GSI Employee HSP Acceptance.....A-31

Figures

Figure 1. Project Area Map A-5

Attachments

Attachment 1 Incident Report Form
Attachment 2 Near-Miss Report Form
Attachment 3 Safety Data Sheet
Attachment 4 Modification to HSP Form
Attachment 5 OSHA Fact Sheets and Information
Attachment 6 Novel Coronavirus Guidelines

Page left blank intentionally.

Acronyms and Abbreviations

AED	automated external defibrillator
Cargill	Cargill, Inc.
CFR	Code of Federal Regulations
COC	contaminant of concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone
F	Fahrenheit
FSO	Field Safety Officer
GFCI	ground fault circuit interrupter
Glacier	Glacier Northwest, Inc.
H&S	Health and Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSP	Health and Safety Plan
ID	identification
LOTO	lock-out/tag-out
mph	miles per hour
NRC	National Response Center
OSHA	U.S. Occupational Safety and Health Administration
PCBs	polychlorinated biphenyls
PDF	portable document format
PFD	personal flotation device
PM	Field Investigation Project Manager
Portland Harbor	Portland Harbor Superfund Site
PPE	personal protective equipment
PVC	polyvinyl chloride
RM11E	River Mile 11 East
SAP	sampling and analysis plan
SDS	safety data sheet
Site	RM11E Project Area
SZ	Support Zone
TBD	to be determined
USCG	U.S. Coast Guard

Page left blank intentionally

.

1. Introduction

This site-specific Health and Safety Plan (HSP) has been developed for the River Mile 11 East (RM11E) Project Area (Site) in accordance with (OSHA 29 CFR 1910 and 1926, and the GSI Health and Safety Policy. It covers known field hazards associated with the tasks necessary to complete the Scope of Work for the Phase I Remedial Design Sediment Sampling and Analysis Plan. Each subcontractor will also provide their own HSP.

Project Description and Scope of Work: This HSP covers actions to be taken to implement the sampling activities for the RM11E Site (Site), which include surface and subsurface sediment sampling for the over-water region and sample processing. The next phase of work will include soil sampling for the upland region. Table 1 lists GSI's field staff members' roles and responsibilities. See the Sampling and Analysis Plan (SAP) Section 2 for further details.

Table 1. GSI Field Staff Members

Name	Role	Responsibility
Dave Livesay	Field Investigation Project Director (PD)	The GSI PD has overall responsibility for the delivery of the project and management of all members of the team, including external advisors and subcontractors. The PD and Project Manager (PM) are the points-of-contact for the client and regulatory agencies.
Alison Clements	Field Investigation Project Manager (PM)	The GSI PM has responsibility and authority to direct all work operations. The PM will work closely with the PD, and is a point of contact for the client and regulatory agencies. The PM will coordinate safety and health functions with the Field Safety Officer (FSO), has the authority to oversee and monitor the performance of the FSO, and bears ultimate responsibility for the proper implementation of this HSP. The GSI PM is responsible for field operations and ensures the implementation of the HSP requirements and procedures in the field.
Benjamin Johnson	Sampling and Analysis Coordinator	The GSI FSO has full responsibility and authority to coordinate with sampling contractors, laboratories, and field staff. The SAC will work closely with the PM and lead engineer to ensure data are collected in accordance with the SAP and serve as the Field Quality Assurance Manager to ensure that all appropriate field procedures and methods are followed.
John Gauthier	Field Safety Officer (FSO)	The GSI FSO has full responsibility and authority to develop and implement this HSP and to verify compliance. The FSO is onsite or readily accessible to the site during all work operations and has the authority to halt site work if unsafe conditions are observed or suspected.

Table 1. GSI Field Staff Members		
Name	**Role**	**Responsibility**
Additional GSI Staff	Field Activities	GSI's staff will be responsible for complying with this HSP, using the proper personal protective equipment (PPE), reporting unsafe acts and conditions, and following the work and safety and health instructions of the PD, PM, FSO, and site-specific HSP and protocols.
Subcontractors	Field Activities	Subcontractors will be responsible for their own HSPs.

Note
All personnel requiring access to controlled work areas must have completed the appropriate training. If field personnel change, substitutions will be made with similarly qualified personnel.

All other consultants, sub-consultants, and subcontractors will prepare their own HSPs--which must meet or exceed the minimum requirements identified by OSHA 29 CFR 1910 and 1926—and will be responsible for their own health and safety. Any modifications to this HSP will be attached to this document.

2. Site Description

The Site includes two upland active industrial facilities: Cargill, Inc. (Cargill) and Glacier NW, Inc. (Glacier). Figure 1 is a map of the entire Site.

Staff will comply with site entry requirements for each upland facility, as described below. Do not come into contact with, or access, anchoring, or mooring ships without prior approval. Due to operational and site security limitations that may interfere with, or delay access to, waterfront and over-water structures as a result of vessel traffic and other marine operations, the PM will coordinate access with designated site representatives for Cargill and Glacier and others.

2.1 Description of Cargill Facility

Access: Secure facility. Site access will require ID badge, hard hat, safety vest, steel-toed boots, and safety glasses.

Approximate Size: 6.3 acres

Topography: Relatively flat and mostly paved with numerous buildings and structures. Greenway planter strip present along the top of bank in the northern portion of the property. The riverbank is steep with armoring on the northern end of the property and a metal sheet pile retaining wall along the southern bank.

Site Status: Active. Haulage and heavy equipment operations are anticipated. Active boat traffic on the river and dock activities near several sampling locations are anticipated.

Site Operations: Cargill operates a grain elevator and shipping terminal (the Irving terminal) in this location. This facility provides interim bulk storage for transfer of grain to and from trucks, rail cars, barges, and ships. The main features on the site are reinforced concrete grain silos, conveyor systems, enclosed grain processing, a rail grain dump station, a truck grain dump station, and shipping and unloading equipment (Black & Veatch, 2011). An active dock extends over water and remnant piling fields are present along the shoreline, behind the main dock.

2.2 Description of Glacier Facility

Access: Secure facility. Site access will require ID badge, hard hat, safety vest, hearing protection, and steel-toed boots (as well as gloves where appropriate). Transportation Worker Identification Credential badges are required when a ship is at dock. Glacier can provide escorts, although the number of people that can be escorted is limited.

Approximate Size: 3.3 acres

Topography: Relatively flat and mostly paved, with numerous buildings and structures. Greenway planter strip present along the top of bank. The riverbank is steep with armoring.

Site Status: Active. Haulage and heavy equipment operations are anticipated. Active vessel traffic on the river and dock activities near several sampling locations are anticipated.

Site Operations: Glacier operates a bulk cement storage and distribution terminal at this location. No manufacturing or processing occurs. The site also serves as the company regional headquarters. Bulk cement is delivered by ship, pneumatically conveyed to storage buildings, and then loaded into trucks and railcars for offsite delivery. The site includes 15 storage silos with capacities ranging from 1,000 to 6,500 tons and a cement storage dome with a capacity of 30,000 tons, two off-shore docks, and two covered truck loading and scale areas (ERM, 2011).

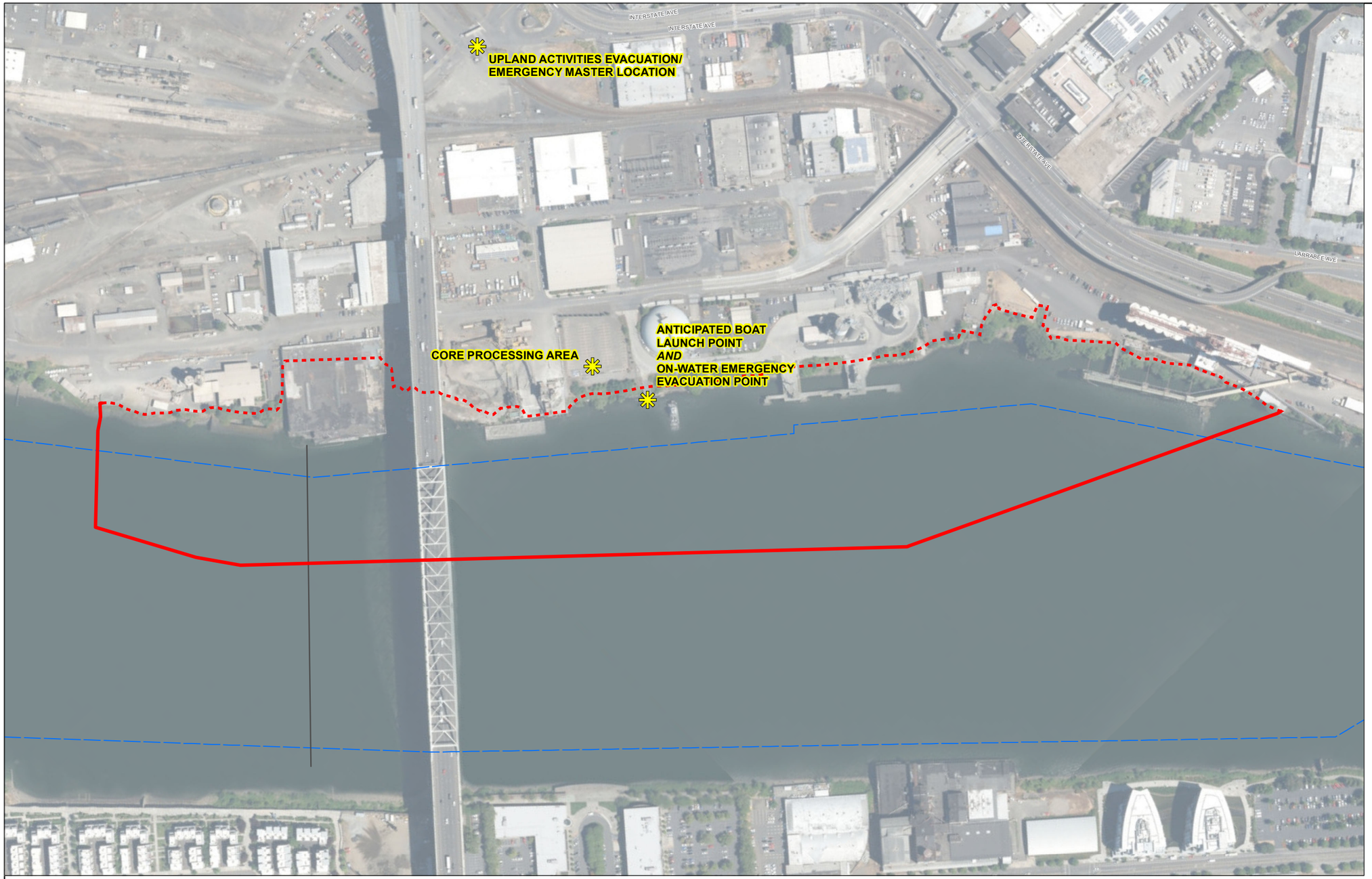


FIGURE 1

Project Area

Health and Safety Plan

River Mile 11 East
Willamette River
Portland, Oregon

LEGEND

RM11E Project Area
(dashed indicates inferred top of bank)

U.S. Army Corps of Engineers
Navigation Channel

NOTES:
NAVD88 = North American Vertical Datum of 1988
1. The locations of all features shown are approximate.
2. RM11E Project Area includes sediment below an elevation of
+13 ft NAVD88 and the adjacent riverbank area to the top of bank.

N

0 150 300 450
Feet

Date: May 15, 2020
Data Sources: BES, USACOE, METRO,
Air Photo COP 2015

GSI Water Solutions, Inc.

Document Path: Y:\0487_DOF\Source_Figures\SAP\HASP\Figure1_Project_Area.mxd

Page intentionally left blank.

Table 2. Locations of Nearest Facilities	
Telephone	Employees should keep fully charged cell phones onsite. For remote sites or extended field days, it is recommended that a car charger or fully charged power block be available. For over-water work, radios will be used as a backup communication method.
Water Source	Employees will be provided access to clean drinking water. The FSO will ensure that sufficient water supply is maintained.
Restroom	Varies. Will be identified in the field before starting work.
Personal Hygiene	Hand wash stations, hand washing water and soap, and/or hand wipes will be supplied at all times. Personnel must not eat food, drink, or smoke around working areas.

3. Directions to the Nearest Emergency Medical Facility

For Over-Water Work

The **overwater muster point** will be the dock located at Glacier facility on the east bank. From the dock, field staff will proceed over the gangway to the core processing facility on the upland Glacier property. Directions to the nearest emergency facility from the upland Glacier property are below under "For Upland Work."

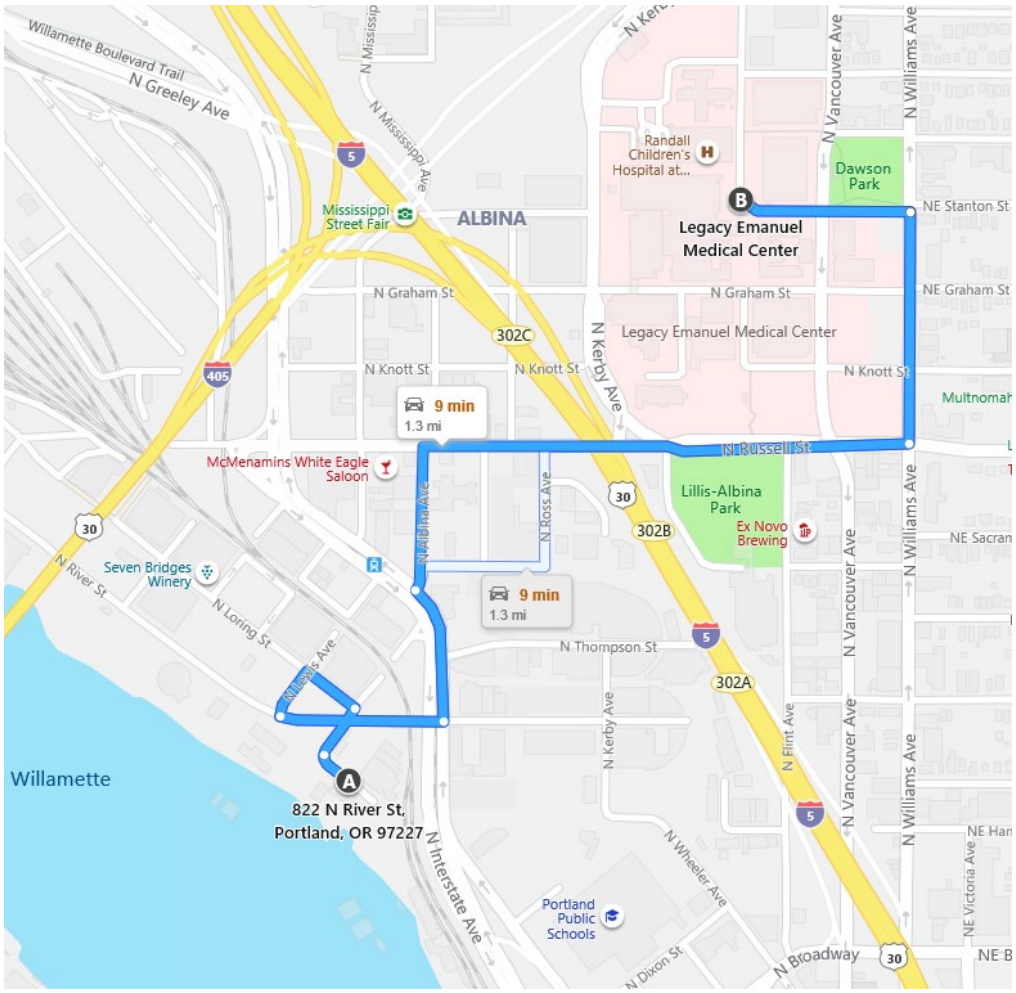
For Upland Work

The **upland muster point** will be outside the client facility gates at the corner of N. River Street and N. Albina Avenue.

Directions to the nearest emergency facility (1.3 mi) from 822 N. River Street to Legacy Emanuel Medical Center (2801 N Gantenbein Avenue, Portland, OR 97227):

1. Head northwest on N River Street toward N Albina Avenue (157 ft).
2. Road name changes to N Albina Avenue (243 ft).
3. Turn left onto N Loring Street, and then immediately turn left onto N Lewis Avenue (489 ft).
4. Turn left onto N Tillamook Street (0.1 mi).
5. Turn left onto N Interstate Avenue (0.1 mi).
6. Turn right onto N Albina Avenue (0.1 mi).
7. Turn right onto N Russell Street (0.4 mi).
8. Turn left onto N Williams Avenue (0.2 mi).
9. Turn left onto N Stanton Street (0.1 mi).

The trip takes approximately 9 minutes, depending on traffic.


Willamette Boulevard Trail
N Greeley Ave
N Mississippi Ave
Mississippi Street Fair
ALBINA
Randall Children's Hospital at...
Dawson Park
Legacy Emanuel Medical Center
NE Stanton St
N Graham St
NE Graham St
Legacy Emanuel Medical Center
N Knott St
N Kerby Ave
N Vancouver Ave
N Williams Ave
9 min
1.3 mi
N Russell St
McMenamins White Eagle Saloon
N Albina Ave
N Ross Ave
Lillis-Albina Park
Ex Novo Brewing
Seven Bridges Winery
N River St
N Loring St
N Lewis Ave
N Thompson St
N Flint Ave
N Wheeler Ave
Willamette
822 N River St,
Portland, OR 97227
N Interstate Ave
Portland Public Schools
N Dixon St
N Broadway
NE Victoria Ave

4. Emergency Procedures

All employees will be expected to assess emergency conditions and have the authority to issue stop-work or evacuation instructions based on the situation and their best professional judgment. Emergency procedures will be discussed during daily safety briefings. Emergency evacuation may occur as the result of a medical emergency (life-threatening) or site condition (e.g., gas line rupture, spills).

In the event of emergency, personnel will be instructed to leave the site immediately and ***the FSO (or onsite field lead if the FSO is unavailable) will contact the appropriate emergency response providers***, listed in the contacts table on Page 1 of this HSP. Directions to the nearest medical facility from the evacuation dock location for on-water work and the muster point for upland work are provided at the beginning of this HSP. An incident report will be completed (see Section 12 and Attachment 1).

In the case of a "near-miss" incident (close to resulting in injury, an unsafe condition, or actual or potential property damage), a near-miss report will be completed (See Section 12 and Attachment 2).

At least one GSI field personnel at each task location will be trained in first aid procedures (including cardiopulmonary resuscitation [CPR]) and have access to a first aid kit. Consistent with OSHA recommendations, an automated external defibrillator (AED) will be available onsite. All field staff will be trained to administer the AED. The AED and first aid kit will be located central to sampling activities in an unlocked location and the AED will include a procedures diagram for use. The FSO will check the AED periodically for sufficient battery charge.

In the event of an occupational accident or incident, please indicate to the medical facility that this is a Workers' Compensation case, that your employer is GSI, and that the insurance administrator for Workers' Compensation claims is SAIF Corporation.

Table 3. Safety Equipment	
First Aid Kit	Required for all work.
Class ABC Fire Extinguisher	Required for all work. Responsibility of marine contractor for over-water work and drilling contractor for shoreline work.
Whistle/air horn	Required for over-water work. Recommended for upland work.
Spill equipment (sorbent pads, booms, etc.)	Responsibility of marine contractor for over-water work and drilling contractor for shoreline work.
Eye wash station	Required for all work.
Wheel chocks	Required on vehicles parked in areas on steep slopes. Emergency brake must be used at all times.

Table 3. Safety Equipment	
Flashlights, head lamps	Required when working between dusk and dawn. Lighting support also required when visibility is less than 5 foot-candles within 3 feet of worker.
Automated External Defibrillator (AED)	Required for all work.
Personal Flotation Device (PFD)	Required for over-water work.

5. Hazard Identification

Table 4. Hazard Identification	
Potential Hazard	**Description of Hazard and How to Avoid Hazard**
Vehicle Travel and Vehicular Traffic	On public roads, adhere to traffic regulations and speed limits. Within the boundaries of client facilities, comply with site requirements for motor vehicles. Where possible, move the vehicle to be close to the sampling location. Inspect the area for access, soft ground, and obstacles that may damage the vehicle. If possible, drive in and drive out of the location, rather than reversing. If you need to reverse, use a spotter to guide you. Use wheel chocks when parked on steep slopes.
Cold Stress/Hypothermia	Drink plenty of fluids (not caffeine), wear clothing appropriate for the weather conditions, wear multiple layers. Avoid cotton clothing when possible. Monitor workers for signs of cold stress. Refer to ***Preventing Cold-related Illness, Injury, and Death among Workers*** (Attachment 5).
Heat Stress/Heat Stroke	Drink plenty of fluids (not caffeine), wear clothing appropriate for the weather conditions. Monitor workers for signs of heat stress. May use a wet bulb thermometer in high-humidity conditions to verify heat index. Remember humidity on the water may be higher than weather station reports. Refer to ***Protecting Workers from Heat Stress*** (a fact sheet produced by OSHA). Keep **Heat Stress Quick Cards** available for workers as needed (Attachment 5).
Slips/Trips/Falls and Unstable/Uneven Terrain/Steep Grades/Elevated Surfaces	Refer to ***Slips, Trips, and Falls and Walking Working Surface An Overview*** (Attachment 5).
Machinery (e.g., welding, cutting, grinding)/Mechanical Equipment/Heavy Equipment (e.g., drill rig, backhoe)	Stand clear of machinery when in operation and be familiar with emergency stop devices, if applicable. No loose clothing to be worn and all long hair (hair extending below the shoulders) to be tied back. If safety vests are worn, they must be fastened at the front. Stay clear of hoisting operations (drill rod attachment and detachment). Be aware of all pinch points and provide guarding where possible. Be aware that heavy equipment activity may change daily or hourly, with differing potential hazards that need to be identified and addressed. Maintain eye contact with operator and wait for clearance before entering active work zone.
Manually Lifting Hazards	Assess the load to be lifted, loaded, pushed, or pulled. Solicit help if the load cannot be safely moved by one person or if handling the load is too awkward. Lift with knees and hold load close to body. Make sure footing is firm, path is clear, and avoid twisting. Use same techniques when setting load down.
Hazardous Insects/Plants/Animals	Site hazards may include bees, snakes, spiders, and ticks. Avoid contact – seek medical attention if necessary. Wear insect repellent, as appropriate. Survey the area for poison oak and use appropriate caution.
Electrical Hazards	Electrical equipment should be inspected to ensure it is in safe working order before use. Equipment should be grounded and operated under dry conditions. All portable electrical equipment must be plugged into a Ground Fault Circuit Interrupter (GFCI) prior to connecting to power source.
Overhead Hazards	Look up to determine location of hazard(s). If overhead hazards exist, change the location of the work to be performed where possible, otherwise, secure the overhead hazard(s) (e.g., de-energize live electrical lines).

Table 4. Hazard Identification	
Potential Hazard	**Description of Hazard and How to Avoid Hazard**
	Stand clear of drill rig and facility operations. Do not walk under a raised load or a load supported by a winch. Stand uphill from drilling activities (if possible) as falling drill strings may roll. Drill rig masts and similar should be given an exclusion zone of 1.5 times the mast height wherever feasible, in case of failure.
Over Water/Near Water	At least two employees will be present during over-water or near-water (defined as within 10 feet of water's edge) activities. Employees will wear U.S. Coast Guard (USCG) for U.S. operations-approved personal flotation devices (PFDs) (i.e., life jacket or buoyant work vest) at all times when on the sampling vessel or when conducting any over/near water activities. The USCG-approved PFDs are Type II PFDs. Employees should inspect life jackets or work vests daily before use for defects. Do not use defective PFDs. Defective PFDs will be tagged and removed from service. There is a potential for a man overboard situation while the team is working over water on the research vessel or from the dock. This potential is increased when heavy equipment is being used or during stormy weather. If a person falls overboard, all vessel engines will be stopped immediately, and the vessel captain will direct activities. Flotation devices and throw ropes (e.g., life rings) attached to lines will be thrown to the victim from the vessel. The victim then will be brought aboard the research vessel or towed to shore; wet clothes will be removed and replaced with dry blankets or clothing as necessary. No other person shall enter the water during a man overboard event unless the victim is unconscious or seriously injured. Rescuers must wear life preservers and be tethered to the research vessel or shore. Ensure that working platforms are secured with no tripping hazards; surfaces that become wet and slippery should be cleaned and dried to the extent possible; guard-rails and toe boards should be checked periodically to ensure they are firmly fixed; PFDs should be worn at all times; life buoys fitted with lifelines should be provided and be ready for use at all times; be aware of vessel traffic; be aware of the potential for rapidly changing conditions (e.g., high flows in response to intense rainfall) and drifting debris (e.g., snags) that could collide with vessel. Employees will use extreme care when getting on and off the vessel, especially when carrying equipment or transferring samples.
Subsurface Utilities	Check for the location of underground services by reviewing presence/markings of underground utilities with relevant field staff before beginning ground-penetrating work. OSHA regulations require the estimated location of utility installations (sewer, telephone, fuel, electric, water lines or any other underground installations that reasonably may be expected to be encountered during excavation work) will be determined before opening an excavation. Use a service locator and the following cues to assist in identifying possible underground services: (1) signs of patched or missing of pavement; (2) service boxes, pits, and manholes as they may indicate the presence or alignment of services; and (3) note services coming into or out of the ground, like power lines and downspouts. When possible, shut off utilities that are in the area while drilling is taking place. Consider less intrusive boring methods for shallow soil, such as using vac-truck/air-knife or hand-auguring to a given depth below surface for physical confirmation of

Table 4. Hazard Identification	
Potential Hazard	**Description of Hazard and How to Avoid Hazard**
	absence/presence of utilities. Ensure upland drilling complies with the client facility's intrusive work requirements, when policy exists.
Splashing	Care should be taken during sample collection activities to prevent liquids from splashing onto skin, clothing, and face. Sampling equipment should be handled carefully (e.g., placed, opened, moved) to prevent splashing. If splashing occurs, the area should be rinsed with clean water and dried, when possible. Safety glasses should be worn during sampling activities and during any activities with splash potential. Consider goggles or face shields and aprons where hazardous liquids are utilized, if applicable.
Excessive Noise	Have hearing plugs or sound-insulating headphones available. See Section 11 for further information.
Fire	Sound an emergency alarm (one long blast on a canned siren or use of site radio) to notify nearby workers. Decide whether to call the fire department for outside assistance or to extinguish the fire with an accessible class ABC fire extinguisher. Trained emergency crews will be summoned to control any large-scale or potentially unmanageable incidents. Follow client facility emergency procedures when working in the uplands.
Sharp Objects (e.g., nails, metal shards, exposed rebar, glass, sharps)	Employees should look for and scan the work area for the presence of sharp objects to avoid contact (such as stepping or sitting on them) and potential injury. Remove or protect other workers from exposure to hazard, where possible and safe to perform. Particular care should be taken in areas where debris is present. If sharps are present, steel-shanked boots should be considered where it provides increased worker protection. Leather gloves should be worn at all times when moving or coming into contact with materials that pose a cut or puncture risk.
Inclement Weather (e.g., ice, snow, lightning)	Work will cease if precipitation (snow, rain, freezing rain) is severe enough to impair safe movement/travel, lightning is in the immediate area, or excessive winds, flooding, or other conditions are determined by the PM. See Section 11 for further information.
Ultraviolet Light Exposure	Wear appropriate clothing, hats, and sunscreen to prevent sunburn.
Unknown Chemicals	**This HSP may need to be modified.** Work will be stopped if visual or olfactory observations indicate unanticipated conditions.
Bloodborne Pathogens	First aid responders have the potential to be exposed to bloodborne pathogens. The potential for exposure to bloodborne pathogens outside of emergency response is not anticipated. While rendering first aid where exposure to bodily fluids or blood may occur, responders will wear, at a minimum, latex or nitrile gloves and a face shield or safety glasses. GSI employees are not required to administer first aid. GSI employees are required to immediately assess any emergency situation and seek professional assistance as appropriate.

Table 4. Hazard Identification	
Potential Hazard	**Description of Hazard and How to Avoid Hazard**
COVID-19	OSHA recommends training all workers with reasonably anticipated occupational exposure to Coronavirus Disease 2019 (COVID-19) about the sources of exposure to the virus, the hazards associated with that exposure, and appropriate workplace protocols in place to prevent or reduce the likelihood of exposure. Training should include information about how to isolate individuals with suspected or confirmed COVID-19 or other infectious diseases, how to use sanitary practices and PPE to protect workers, and how to report possible cases. See Attachment 6, Novel Coronavirus Guidelines for more information.

6. Potential Chemical Hazards

6.1 Chemicals of Concern

Based on surface sediment sample data in RM11E, the primary chemicals of concern (COCs) anticipated at the Site include polychlorinated biphenyls (PCBs) and dioxin/furans. These chemicals are relatively nonvolatile and pose a low risk for inhalation. Chemicals will be bound in a wet or damp solid matrix (i.e., the sediment or soils), and personnel will be typically working in an open-air environment. Nonetheless, these compounds are potentially hazardous and exposure by all routes should be minimized.

Chemicals identified onsite or anticipated to be present onsite:

- PCBs
- Dioxins/furans

Chemicals used on this project for decontamination purposes include the following:

- Liquinox detergent

Hazardous material container(s) must be properly labeled with the identity of the hazardous chemical(s) and the appropriate hazardous warning information. The PM will ask the client for copies of safety data sheets (SDSs) for any hazardous materials in use at the site. The FSO or PM will orient GSI employees and subcontractors to the potential hazards posed by chemicals used and present onsite.

6.2 Potential Chemical Exposure Pathways

The primary routes of exposure for site chemicals include skin contact with contaminated materials and ingestion of materials from hand-to-mouth contact due to inadequate personal hygiene. To minimize these exposure pathways, all required PPE as specified in the following sections will be worn, and personal hygiene will be carefully monitored.

7. Personnel Protection

The prescribed methods and procedures used to protect personnel (field workers and adjacent community) from overexposure to hazardous materials and hazardous conditions posed by site operations are grouped into three primary categories: Administrative Controls, Engineering Controls, and PPE.

7.1 Administrative Controls

7.1.1 Medical Monitoring

GSI employees anticipated to spend more than 29 days at Hazardous Waste Operations and Emergency Response (HAZWOPER) sites or be required to wear a respirator are enrolled in GSI's Medical Monitoring Program. Use of air purifying respirators is not anticipated and, if required, field personnel must be enrolled in GSI's Medical Monitoring Program.

7.1.2 Periodic Comprehensive Exam

All personnel requiring access to controlled work areas will have completed a baseline medical examination and a periodic (usually annual) medical examination before assignment, in accordance with the OSHA 29 CFR 1910.120(f). The exam must be performed by an Occupational Health Physician, who will provide written clearance for hazardous waste site work and for respirator usage. Protocols for the baseline, periodic, and exit exams must be at least as stringent as those defined in the GSI's Medical Monitoring Program.

7.1.3 Medical Clearance Record Keeping

Medical clearance documents are on file at GSI's office located in Portland, Oregon. To ensure confidentiality, results of the medical exams or treatment records are maintained at the medical care provider's clinical offices.

7.1.4 Training

Table 5. Training Requirements for Project

Type of Current Certificate*	Yes	No	Trained GSI Employee(s)
HAZWOPER 40-Hour	X		Required for all GSI field personnel working on HAZWOPER projects.
HAZWOPER Annual 8-Hour Refresher	X		Required for all GSI field personnel working on HAZWOPER projects (after having the 40-hour certification for one year).
HAZWOPER Supervisor Training	GSI Employee-Specific		Supervisors will have completed the above and an additional 8 hours of OSHA Management and Supervisory Training. The FSO and PM will have this training.
First Aid/CPR/AED	X		Required for all GSI field personnel. First aid/CPR/AED training is provided to allow employees to voluntarily administer first aid or medical assistance to family, friends, or coworkers as Good Samaritans. GSI employees are not required to administer first aid.

Table 5. Training Requirements for Project			
Type of Current Certificate*	**Yes**	**No**	**Trained GSI Employee(s)**
			GSI employees are required to immediately assess any emergency situation and seek professional assistance as appropriate.

Note
All GSI employees' certificates are on file in GSI's Portland, Oregon, office. Field projects will not be allowed to take place in the absence of adequate documentation.

7.2 Engineering Controls

7.2.1 Barriers and Signs

Barricades, traffic cones, and/or marking or caution tape will be erected at a safe distance from excavations, pits, hazardous areas, driller working areas, and moving equipment to prevent unauthorized access to work areas from vehicular and pedestrian traffic. Barriers will be appropriate for the level of work activity and anticipated traffic. Signage or work boundary delineation will be installed, as necessary.

7.2.2 Work Zones

Work zones are defined below. In the case of limited space, especially for over-water work, the Contamination Reduction Zone (CRZ) and Exclusion Zone (EZ) may be combined. Work zones will be defined and labeled once vessels and work areas have been confirmed.

All project area visitors (except OSHA inspectors) must receive prior approval from the PM and client, and may do so only for the purposes of observing project area conditions or operations.

Support Zone (SZ)

The SZ will be located away from the contaminated area. Vehicles, emergency equipment, the telephone and break area, and any nonessential personnel will be located in this area. SZ areas for the RM11E project include part of the Core Processing Area, Swan Island Boat Ramp, designated on-water platform location to be defined in the field by the FSO, and areas within client facilities in the uplands to be defined in the field by the client and FSO.

Contamination Reduction Zone (CRZ)

Decontamination lines will be established for personnel and sampling equipment in the CRZ. Personnel and equipment will pass from the EZ through the CRZ to the SZ. Coolers in this zone will be protected from contamination and decontaminated before leaving the Site.

Exclusion Zone (EZ)

The EZ is defined around intrusive activities or located in the immediate hazard area. The EZ is often identified by cones, hazard tape, or other means to notify unauthorized individuals of the presence of potential hazards. Access should be restricted to field sampling crews and necessary equipment operators.

7.3 Personal Protective Equipment

7.3.1 Levels of Protection

Initial levels of protection for the Site may vary depending on the task. All personnel entering controlled work zones initially will be required to wear the U.S. Environmental Protection Agency (EPA)/OSHA Level of Protection as specified in this plan in Table 6.

Protection may be upgraded or downgraded depending on monitoring data (compared with action levels) and Site conditions, as determined by the FSO. Table 6 and the following sections outline the **minimum** guidelines for each level of protection that is assigned or potentially assigned.

Table 6. PPE to Be Used

PPE[1]	Over-Water Work	Upland Work	Core Processing
Steel-toed boots (leather or neoprene safety, slip- and chemical-resistant, waterproof)	X	X	X
Gloves (leather, nitrile, etc.)	X	X	X
Eye/face protection (safety glasses, goggles, or face shield)	X	X	X
Hard hat	X	X	
Splash protection (polyvinyl chloride [PVC] bibs/aprons, or Tyvek coverall)	X	X	X
Hearing protection	X	X	
Clothing (long pants and shirts with sleeves; cold-weather gear, rain gear, as appropriate)	X	X	As necessary
Heavyweight rain gear (if raining)	X	X	
Personal flotation device (Type II)	X		

Note

[1]During sampling activities, gloves and PPE appropriate for the expected contaminants that may be encountered will be worn. When selecting PPE, consider potential exposure routes associated with the contaminant (e.g., inhalation, ingestion, skin contact).

7.3.2 PPE Failure/Chemical Exposure

In the event of PPE failure, the worker and/or buddy will cease work, perform personal decontamination procedures (Section 8), and exit to the SZ/CRZ. Refer to the SDS (Attachment 3) and Section 13 if emergency medical response is needed. If chemicals contact the eyes, irrigate for 15 minutes and consult a physician.

7.3.3 PPE Inspection, Storage, and Maintenance

Reusable PPE will be decontaminated, inspected, and maintained, as necessary, after each use. Any inspected PPE found to be damaged will be tagged and removed from service. Personal equipment (e.g., hard hat, steel-toed boots) will be properly stored by the employee/subcontractor. The FSO will periodically inventory the disposable and reusable PPE at the Project Area and will replenish stocks in a timely manner.

8. Decontamination Procedures

Procedures for the decontamination of sampling tools and other related equipment are specified in Section 4 of the SAP and Table 7 below. Note that separate areas should be established for personnel, sampling, and heavy equipment decontamination (discussed in Section 7.2.2).

8.1 Personnel Decontamination

Field personnel will wash hands and face after removing PPE.

Table 7. Decontamination Equipment and Procedures

Equipment	Decontamination Solution	Procedures	
		Intermediate	Final
Long-handled, soft-bristled brushes Galvanized wash tubs or equivalent Pump-activated sprayer Garbage cans with plastic liners and drums with liners Plastic sheeting Paper towels Duct tape	Liquinox Tap water for rinsing	Dispose of or wash outer boots and gloves with Liquinox solution. Rinse outer boots and gloves. Remove outer gloves. Enter CRZ for sample management. Return to EZ wearing new or cleaned outer gloves.	Segregate equipment drop (for instruments and equipment requiring special decontamination, see the SAP). Dispose of or wash outer boots and gloves with Liquinox solution. Rinse outer boots and gloves. Remove and dispose of outer boots. Remove and dispose of outer gloves (if not cleaned to “like new” condition). Remove and dispose of coverall. Remove and dispose of inner gloves in designated receptacle. Field wash for personal hygiene. Exit to SZ.

Notes
Intermediate decontamination is for periodic exits from the EZ during sample transport and management or for short breaks. Final decontamination is performed before eating, when taking cool-down breaks, and when exiting the Site.

8.2 Equipment Decontamination

All equipment that will potentially contact samples will be decontaminated before and after sampling events according to procedures specified in SAP Section 4. Heavy equipment in direct contact with soil and/or groundwater, such as the drill rig augers and backhoe buckets, will be decontaminated by the subcontractor.

8.3 Emergency Decontamination

In the event of an accident or incident where work must cease and staff must exit the EZ, emergency decontamination should be performed to the greatest extent feasible. In an emergency, the primary concern is to prevent the loss of life or severe injury. If immediate medical attention is required to save a life, decontamination should be delayed until the victim is stabilized. If the decontamination can be performed without interfering with essential life-saving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe illness or loss of life, decontamination must be performed immediately. If an emergency resulting from a heat-related illness develops, protective equipment should be removed carefully from the victim as soon as possible.

Any time emergency decontamination methods must be used, an incident report (see Attachment 1) must be completed by the FSO and submitted to GSI's Safety Committee.

9. Disposal Procedures

Soils and wastes generated from sampling events will be characterized in advance to determine appropriate disposal procedures. Waste PPE, including used nitrile gloves, will be contained in garbage bags and disposed with common waste as described in the SAP, Section 4. All visibly impacted soil or sediment and water generated during drilling and sampling will be contained in 55-gallon drums and drummed materials will be profiled to evaluate disposal options as described in SAP Section 4. All visibly impacted materials, or anything not contained in the common waste stream, will be labeled appropriately as potentially hazardous while awaiting profiling. Construction of temporary stations for personnel and other sampling equipment will be the responsibility of the FSO.

10. Communications

10.1 Daily Tailgate Safety Meetings

Tailgate safety meetings will be conducted by the FSO or PM each morning before work begins or before the following:

- A change of work tasks or conditions
- When new employees join the crew
- If site conditions change unexpectedly or when a specific task or location poses a safety hazard
- To review proper use of PPE

Topics of discussion will include work tasks and designated PPE, emergency procedures, evacuation routes, instruction in the use of safety equipment (as required), prior safety problems, and similar topics. These meetings must be documented in the field notebook or Tailgate Safety Meeting Checklist.

10.2 Buddy System

The "buddy system" will be used during field activities involving potential exposure to hazardous or toxic materials, for over-water or near-water work, and during any work within the EZ. Each person will observe his/her buddy for symptoms of chemical exposure, cold stress/hypothermia, or heat stress, and will assess any emergency situation and seek professional assistance as appropriate. A cell phone will be maintained at the Site for emergency use.

Table 8 presents emergency hand and horn signals that will be used, as necessary, where verbal communication is limited.

Table 8. Emergency Hand and Horn Signals

Thumbs up	=	OK; understand
Thumbs down	=	No; negative
Grasping buddy's wrist	=	Leave Site now
Hands on top of head	=	Need assistance
Horn - one long blast	=	Evacuate Site
Horn - two short blasts	=	All clear; return to Site

11. Safe Work Practices

11.1 Accident Prevention

The FSO and all site employees will inspect the work area and/or Site daily to identify and correct any unsafe conditions. GSI field personnel and subcontractors should inspect the work area thoroughly before leaving the Site. Adherence to the safe work practices and procedures outlined in this HSP will assist with accident prevention.

Access will be limited to all controlled areas via the prescribed administrative (certifications) and engineering (barricades) controls, as described above. All site staff and visitors will note arrival and departure times on a field log maintained by the FSO.

11.2 Personal Conduct

- Unauthorized personnel are not allowed on the Site.
- A high standard of personal hygiene will be observed. Smoking, eating, drinking, chewing gum or tobacco, taking medication, and applying cosmetics will not be permitted within the EZ or CRZ.
- Personnel under the obvious influence of alcohol or controlled substances are not allowed at the Site; those taking medications that could impact ability to safely perform work must notify the FSO before beginning work.
- All project area personnel will familiarize themselves with these practices and the emergency procedures during daily tailgate and pre-work safety meetings.
- No "horseplay" or unsafe actions or activities will be allowed.
- GSI employees who are passengers or drivers of vehicles will wear their seat belts any time the vehicle is in motion.
- Cell phone use while driving is not permitted.

11.3 Work Limitations

All field activities will be conducted to the best of the project's ability during daylight hours. However, as some or all of the work may occur during short daylight periods of the year, support lighting will be required where work is conducted between dusk and dawn. Due to client facility operations, work may be performed on weekends and evenings. Work hours should be limited to no more than 60 hours per week with at least one day off per week and no more than 12 hours per day worked without pre-approval by the PM.

11.4 Equipment and Activities

- All unsafe conditions will be corrected immediately. All unsafe conditions not in the scope of the project will be reported to the FSO and the condition corrected.
- Loose-fitting clothing and loose long hair are prohibited near moving machinery.
- Do not fuel engines while the vehicle is running.

- Install adequate site roads, signs, lights, and devices, where applicable.
- Marine vessels are required to have proper lighting and identification, in accordance with U.S. Coast Guard (USCG) regulations. Operators must be properly certified to navigate any on-water vessels.
- Where portable electric tools and appliances can be used (where there is no potential for flammable or explosive conditions), they will be equipped only with three-wire grounded power and extension cords to prevent electrical shock. Use a GFCI to prevent electrical shock is required.
- Store tools in clean, secure areas so they will not be damaged, lost, or stolen.
- Before exiting a vehicle, shift into park, set the parking/emergency brake, and shut off the engine.
- Never leave a running vehicle UNATTENDED.
- All equipment, tools, and property will be secured, as needed, at the end of each day.

11.5 Noise Reduction

Site activities in proximity to welding, construction, and heavy equipment often expose workers to excessive noise. It is anticipated that situations may arise when noise levels may exceed the OSHA Action Level of 85 decibels (A-weighted scale) (dBA) in an 8-hour time-weighted average. An example of this possibility is working in close proximity to the subcontractor during drilling or trenching activities at the Site. If excessive noise levels occur, earplugs with appropriate the Noise Reduction Ratings (NRR) will be issued to all personnel and a system of hand signals understood by all will be implemented (see Table 8). Refer to ***Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure*** (Attachment 5).

11.6 Sanitation

Potable drinking water will be supplied in tightly closed containers and will be clearly marked for its intended use. If vehicles are available for use by field crews, restrooms and a field washing area with potable water will be available within a reasonable distance from the Site. If such facilities are not located within a reasonable distance, portable facilities will be installed for use by field employees.

11.7 Illumination

When fieldwork is to be conducted before dawn or after dusk, or light conditions are less than 5 foot-candles, illumination within all Project Areas and access pathways to those areas will be maintained with facility lighting, temporary light plants, equipment mounted lighting systems, or similar such that illumination at 5 foot-candles or above is provided. In addition, all on-water vessels will comply with USCG vessel lighting requirements.

11.8 Weather Conditions

Weather is always a potential safety factor in performing work in outdoor environments. To ensure worker safety, the following minimum safety rules will be implemented. Modification of work limitations due to weather can only be approved by the FSO or PM.

- **Lightning:** The 30-30 rule is a common rule used for lightning safety and is defined as follows: If lighting is seen, count to 30 seconds. If thunder is heard within 30 seconds (assumes lighting is within 30 miles), workers will shelter in place. In the uplands, shelter in buildings or vehicles. For on-water work, shelter within the cabs of barges or tugs. Sheltering in place will end 30 minutes after the last lighting is seen with thunder occurring within 30 seconds. Weather apps such as Spark can also be used to determine whether lightning is within 30 miles of work area. Refer to ***Lightning Safety When Working Outdoors*** (Attachment 5).
- **Heavy Rains:** The vessel and field staff will be prepared for heavy rainfall events during working hours. If rain falls at a high enough rate to inhibit worker safety or field activities, the FSO will determine whether or not to proceed with work.
- **High winds:** Work will be stopped when sustained winds of more than 15 miles per hour (mph) and/or gusts of over 25 mph occur unless prior approval is provided by the FSO.
- **Freezing temperatures** (defined as <35° F for over-water work): No over-water work will be performed below freezing temperatures without prior approval by the FSO. If work occurs in conditions of below-freezing temperatures, salt or ice melt should be used on barge decks and extreme care must be taken to prevent slips, trips, and falls. Upland work will only be performed with pre-approval by the FSO.
- **Warm temperatures:** Work activities will be limited, reduced, or halted when humidity is greater than 80 percent and temperatures are greater than 90°F, or when temperatures are greater than 100°F, regardless of humidity. Above 85°F, a cooling shelter (location out of direct sunlight) shall be provided and additional rest cycles and personnel monitoring must be considered. Final direction on work and work support will be provided by the FSO. Refer to ***Protecting Workers from Heat Stress*** (Attachment 5).

12. Spill and/or Discharge of Hazardous Materials

12.1 Training

Responses to incidental releases or spills of hazardous substances that can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area are not considered to be emergency responses under 29 CFR 1910.120(l) and do not require additional specialized training.

12.2 Spill Control and Response

There is a potential for incidental spillage/leakage of hazardous materials, if present. Store these materials properly and maintain the appropriate spill response equipment in the area where the materials are used/stored. In case of incidental spills or leaks, follow these steps:

1. Notify the FSO as soon as possible.
2. Select appropriate PPE and response equipment.
3. Contain the spill to the extent possible.
4. Neutralize or solidify the liquid per the SDS.
5. Transfer the material to an appropriate compatible container.
6. Document with an Incident Report (see Attachment 1).
7. PD or PM will notify the client.

12.3 Discharge Control and Response

In the event of an uncontrollable discharge of hazardous material from an existing client structure (e.g., impoundment or tank), the PM will immediately contact the client to coordinate implementation of the client's Emergency Response Plan. GSI personnel shall not assist in emergency response activities, but will evacuate to the upland SZ or the emergency evaluation point for in-water work (see Figure 1).

12.4 Spill Response Reporting

Although spills in reportable quantities are not anticipated, field personnel will be instructed on the requirements and procedures for reporting to state emergency response agencies and the National Response Center (NRC) (contact information is in the table on Page A-i of this HSP). Spills will be reported immediately after the safety of onsite personnel has been secured. Potentially reportable spills include any amount of oil/diesel/gas spilled in water, or more than 42 gallons of oil spilled on land. When reporting to the NRC, include the following information:

1. Your name and company
2. Your telephone number
3. Type of incident and the materials involved
4. Location/time of incident, background/how the incident occurred

5. On-scene contact and how to reach them
6. Severity of incident—threat to people, property, or the environment
7. Actions taken, such as containment and/or evacuation
8. Responsible party and telephone number

12.5 Evacuation Procedures

Expeditious evacuation routes to the SZ will be established daily for all work area locations. Evacuation notification will be **one long blast on a canned siren, vehicle horn, or direct verbal communication**. Emergency drills should be performed periodically. Any additions to evacuation procedures require an update to this HSP.

In the unlikely event that an evacuation is necessary, all personnel will immediately proceed to the uplands SZ or the emergency evaluation point for over-water work, decontaminating to the extent possible for personal safety, based on the emergency. The FSO or PM then should begin the Site security and control measures.

13. Accident Reporting and Record Keeping

13.1 In Case of Emergency Injury or Illness

IN CASE OF EMERGENCY: CALL 911 AS SOON AS POSSIBLE

13.2 In Case of Non-Emergency Injury or Illness

At the onset of a non-emergency employee work-related injury or illness, GSI employees should first notify the supervisor on duty, then notify WorkCare at (888) 449-7787.

GSI management will be contacted by WorkCare following the initial report. The employee is required to report (to the GSI FSO) all work-related and all non-work-related injuries that may affect his/her ability to safely perform their job.

After the initial reporting, the FSO or other designated GSI employee will immediately contact the PD, PM, FSO, or GSI Safety Committee to conduct an investigation jointly with the PM. The FSO or PM will complete the Incident Report (Attachment 1). These completed reports must be transmitted to the Safety Committee within 24 hours of an occurrence; a PDF file is acceptable. The Safety Committee will submit the appropriate reports to GSI's Human Resources Manager (for Workers' Compensation), and OSHA (as applicable).

13.3 In Case of Near-Miss Incident

All "near-miss" incidents (incidents with high likelihood of resulting in injury, illness, significant spill, or property damage), even in the absence of a resultant incident, should be reported to GSI management using the form in Attachment 2. This provides safety tracking metrics to improve site safety in the future.

13.4 Subcontractor Accident Reporting

The foreman or field supervisor of subcontracting crews will investigate and complete an injury/illness report (similar in content to the GSI report) in accordance with their internal company policy. This report must be transmitted to GSI within 24 hours.

In case of environmental incidents, property damage, power disruption, or mandated work shutdowns, an Incident Report (Attachment 1) will be prepared by the FSO or PM. Any damage, loss, or theft of GSI property (items/tools/equipment) will be reported to the PD or PM.

13.5 GSI Accident Reporting to Client

All incidents involving medical attention or significant "near-misses" will be reported to the client as soon as possible. This reporting will adhere to any OSHA or other agency requirements and will be followed up with incident investigations if deemed necessary by GSI or the client.

14. References

Black & Veatch. 2011. Stormwater Assessment Work Plan for The Cargill Irving Grain Elevator and Terminal. Prepared for Cargill, Incorporation. Prepared by Black & Veatch. July 2011.

ERM. 2011. Storm Water Source Control Screening Evaluation Work Plan, Portland Cement Terminal. Prepared for Glacier Northwest Inc. Prepared by ERM-West, Inc. (ERM). May 2011.

15. Signatures

Tables 9 and 10 are for GSI employees to read and sign before working on this project.

Table 9. Signatures for HSP

This signature indicates that the PM is aware of the potential hazards at this site, has reviewed this HSP, and will communicate these hazards and appropriate controls to GSI employees before they travel to the project site and initiate work.

	Name (Printed)	Signature	Date
Prepared by			
Reviewed by			
Project Manager			

Table 10. GSI Employee HSP Acceptance

I have had access to the HSP and opportunity to ask questions about this HSP before beginning work activities on this project. I have received site-specific information and orientation regarding the identified hazards anticipated at the project site. My signature certifies that I understand the procedures, equipment, and restrictions of this HSP and agree to abide by them.

Signature	Name (Printed)	Date

16. Limitations

This HSP was prepared exclusively for the Phase I Remedial Design Sediment Sampling and Analysis Plan for the RM11E project by GSI. The quality of information contained herein is consistent with the level of effort involved in GSI services and based on: (1) information available at the time of preparation, (2) data supplied by outside sources, and (3) the assumptions, conditions, and qualifications set forth in this HSP. This HSP is intended to be used by GSI personnel providing over-water surface/subsurface sampling and upland bank soil sampling activities only, to the terms and conditions of its contract with GSI. Any other use of, or reliance on, this HSP by any third party is at that party's sole risk. The information contained herein is relevant to the facilities before the development of this HSP and should not be relied upon to represent conditions at later dates. In the event that changes in the nature, usage, or layout of the property or nearby properties are made, the information contained in this HSP may not be valid. If additional information becomes available, it should be provided to GSI so the HSP can be modified as necessary.

17. GSI Safety Committee Members

Josh Bale – Chairperson (Employee Representative), Health and Safety Coordinator, and HSP Administrator (Employee Representative)

- Work: 971.200.8502
- Cell: 530.276.4188

Brian Franz – Health and Safety Coordinator and HCP Administrator (Employee Representative)

- Work: 805.979.3082
- Cell: 805.453.8267

Andrew Wentworth – Employee Representative

- Work: 971.200.8534
- Cell: 510.593.0120

John Gauthier – Employee Representative

- Work: 971.200.8529
- Cell: 805.816.3823

Kathy Roush – Management Representative

- Work: 971.200.8527
- Cell: 919.605.6644

Laura Burgess – Employee Representative

- Work: 971.200.8504
- Cell: 503.544.0879

Nate Page – Employee Representative

- Work: 805.460.4622
- Cell: 970.692.3593

Owen McMurtrey – Employee Representative

- Work: 541.257.9005
- Cell: 541.740.5619

Jessica Letteney – Employee Representative

- Work: 971.200.8524
- Cell: 503.410.4431

Attachments

Page left blank intentionally.

ATTACHMENT 1

Incident Report Form

Page left blank intentionally.

Incident Report

Use this form to document information about an accident or incident. Fill out an investigation report as soon as possible. Note: this form is for use within your company. It is not intended to replace DCBS Form 801: *Worker's and Employer's Report of Occupational Injury or Disease*.

Employee(s) name(s): .....

Time & date of accident/incident: .....

Job title(s) and department(s): .....

Supervisor or lead person: .....

Witnesses: .....

Brief description of the accident or incident: .....

.....

Body part affected: .....

Did the injured employee(s) contact WorkCare? ( ) Yes ( ) No

Did WorkCare recommend the employee seek medical attention? ( ) Yes ( ) No

Did the injured employee(s) see a doctor? ( ) Yes ( ) No

If yes, did you file an employer's portion of a worker's compensation form? ( ) Yes ( ) No

Did the injured employee(s) go home during their work shift? ( ) Yes ( ) No

If yes, list the date and time injured employee(s) left job(s): .....

Supervisor's Comments: .....

.....

What could have been done to prevent this accident/incident? .....

.....

Have the unsafe conditions been corrected? ( ) Yes ( ) No

If yes, what has been done? .....

If no, what needs to be done? .....

Employer or Supervisor's signature:

Date:

Additional comments/notes: .....

.....

Page left blank intentionally.

ATTACHMENT 2

Near-Miss Report Form

GSI Water Solutions, Inc.
NEAR-MISS REPORT

1. Name of Employee Involved	**2. Date of Near-Miss**	**3. Time of Near-Miss**
4. Location/Site of Near-Miss Event		
5. Other witnesses present at time of near-miss		

6. Length of time employed by GSI ☐ < 6 months ☐ 6 months – 1 year ☐ 1 – 2 years ☐ 2 – 5 years ☐ Greater than 5 years	**7. Employment Category** ☐ Regular, Full-Time ☐ Regular, Part-Time ☐ Temporary/Seasonal Employee ☐ Non-Employee
8. Familiarity with Activities related to Near-Miss ☐ First Time performing ☐ Observed but never performed ☐ Limited to some familiarity ☐ Regularly perform	**9. Phase of Work Day when Near-Miss Occurred** ☐ Performing Duties during Standard Hours ☐ During meal/rest period ☐ Prior to Starting or At End of Work Day ☐ Working Overtime/Long hours

10. Describe the near-miss:
Description of Event: What was employee doing just before and at the time of the near-miss?

_____

_____

_____

_____

11. What happened or what work conditions contributed to the near miss (e.g., Object/Equipment/Substance)

_____

_____

_____

_____

_____

12. Outcome of near-miss:

_____

_____

_____

_____

_____

13. Task and Activity at Time of Near-Miss:

General type of task:_____

Specific activity:_____

Employee was working:

☐ Alone ☐ With crew or fellow worker ☐ Other: _____

14. Was proper Ergonomic support utilized? Explain

15. Supervision at time of accident

☐ Unsupervised ☐ Supervised

☐ Limited Supervision

16. Factors that contributed to near-miss – Please check all that apply

Hazard

- ☐ Not recognized/identified
- ☐ Identified, but not addressed
- ☐ Inadequately addressed

Work Procedures

- ☐ None developed
- ☐ Not followed
- ☐ Partially followed
- ☐ Not understood
- ☐ Not appropriate
- ☐ Not communicated
- ☐ Other

Training & Certification

- ☐ Insufficient training
- ☐ Circumstances not covered
- ☐ Ineffective training
- ☐ Worker not authorized
- ☐ Outdated Training

Communication

- ☐ Breakdown in verbal communication
- ☐ Breakdown in written communication
- ☐ Confusion after communication
- ☐ Other_____

Other

- ☐ Weather/temperature
- ☐ Extended work hours
- ☐ Worker fatigue
- ☐ Physical overexertion
- ☐ Work in elevated area
- ☐ Chemical Use
- ☐ Biological agent
- ☐ Radiation
- ☐ Electricity
- ☐ Mechanical
- ☐ Animals

Facilities/Equipment

- ☐ Personal protective equipment
- ☐ Faulty equipment
- ☐ Poor/inadequate maintenance
- ☐ Inappropriate use
- ☐ Missing guards
- ☐ Obsolete/antiquated
- ☐ Inadequate design
- ☐ Ergonomic factors
- ☐ Equipment failure
- ☐ Trip hazard
- ☐ Slip hazard
- ☐ Struck by
- ☐ Other_____

Additional Comments:

Page left blank intentionally.

ATTACHMENT 3

Safety Data Sheet

Page left blank intentionally.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Liquinox
Synonyms:
Product number: 1232-1, 1232, 1201-1, 1201, 1205, 1215, 1255

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer **Supplier**
Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
1-914-948-4040

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:
Alcohol ethoxylate
Sodium alkylbenzene sulfonate
Sodium xylenesulphonate
Lauramine oxide

2.2 Label elements:

Eye irritation, category 2A.
Skin irritation, category 2.

Hazard pictograms:

Signal word: Warning

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	10-25
CAS number: 1300-72-7	Sodium Xylenesulphonate	Eye Irrit. 2; H319	2.5-10
CAS number: 84133-50-6	Alcohol Ethoxylate	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	2.5-10
CAS number: 1643-20-5	Lauramine oxide	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	1-2

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.

Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.

Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.

Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.

Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.
Conditions for safe storage, including any incompatibilities:
Store closed upright and in a cool dry place, should be 15 - 30 deg C or 60 - 90 deg F.

7.2 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

8 Exposure controls/personal protection

8.1 Control parameters :

No applicable occupational exposure limits

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	Pale yellow liquid	**Explosion limit lower:** **Explosion limit upper:**	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C:**	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density:**	Not determined or not available.
pH-value:	8.5 as is	**Relative density:**	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities:**	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water):**	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature:**	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature:**	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	**Viscosity:**	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox	
Density at 20°C:	Not determined or not available.

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 >5000 mg per kg Rat, Oral) - product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Alcohol Ethoxylate: May cause mild to moderate skin irritation.

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation.

Alcohol Ethoxylate: Causes moderate to severe eye irritation and conjunctivitis.

Sodium xylenesulphonate: Rabbit: irritating to eyes.

Lauramine oxide: Causes serious eye damage.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC0 24.3 mg/l, 96h [Killifish (Cyprinodontidae)]
Lauramine oxide: Aquatic invertebrates, (LC50): 3.6 mg/l 96 hours [Daphnia (Daphnia)].
Lauramine oxide: Aquatic plants, EC50 Algae 0.31 mg/l 72 hours [Algae]
Alcohol Ethoxylate: Aquatic invertebrates, (LC50): 4.01 mg/l 48 hours [Daphnia (daphnia)].

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None

US DOT

Limited Quantity Exception: None

Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.
Comments: None

Non Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.
Comments: None

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards :	None
14.6 Special precautions for user:	None
Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

14.8 Transport/Additional information:

Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

HMIS: 1-0-0

ATTACHMENT 4

Modification to HSP Form

Page left blank intentionally.

MODIFICATION TO HEALTH AND SAFETY PLAN

Project:

Modification:

_____
_____
_____
_____

Reasons for Modification:

_____
_____
_____
_____
_____
_____

Site Personnel Briefed

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Approvals

Site Supervisor: _____

Site Safety and Health Officer: _____

Other: _____

Page left blank intentionally.

ATTACHMENT 5

OSHA Fact Sheets and Information

Page left blank intentionally.

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Cold-related Illness, Injury, and Death among Workers

Summary

Workers, both indoors and outdoors, in services, transportation, agriculture, construction, and other industries may be exposed to environmental cold stress that can lead to thermal discomfort and in some cases even severe injuries, illnesses, or death. The National Institute for Occupational Safety and Health (NIOSH) recommends that employers implement a cold-related illness and injury prevention program that includes preventive measures such as using engineering controls, establishing work/rest schedules, training workers about the hazards of working in cold environments, and providing appropriate cold-weather gear.

Description of Exposure

Workers who work in cold environments may be at risk of cold stress. Exposure to cold can be an uncomfortable and potentially dangerous situation. Health emergencies can occur in people who work outdoors or in an area that is purposefully kept cold, poorly insulated, or without heat. People who have previously experienced frostbite, sedentary workers, and those with poor circulation may be especially susceptible. For indoor workers, work in cold, damp conditions can be uncomfortable and may lead to declining work performance (i.e., a decline in cognitive function and dexterity) or result in cold-related illness or injury. Cold-related conditions can also worsen musculoskeletal injuries and vascular disorders. For outdoor workers, what constitutes cold stress can vary across different areas of the country. In regions where workers are unaccustomed to winter weather, near freezing temperatures are considered factors for cold stress. Whenever outdoor temperatures drop substantially and wind speed increases, heat leaves the body more rapidly. According to the American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLV®), workers should be protected from exposure to cold so that the deep core temperature does not fall below 96.8°F (36°C) and to prevent frostbite to body extremities [ACGIH 2019]. Serious health problems can occur when the body is unable to stay warm enough.

Photo by MarianVejcik/Getty Images

Cold-related Illnesses and Injuries

Cold-related illnesses and injuries include chilblains, trench foot, frostbite, and hypothermia.

Chilblains. Chilblains are the painful inflammation of small blood vessels in the skin that occur in response to repeated exposure to cold but nonfreezing temperatures. Small blood vessels in the skin may become permanently damaged by cold temperatures, resulting in redness and itching during additional exposures. Symptoms of chilblains include redness, itching, possible blistering, inflammation, and possible ulceration in severe cases.

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Trench Foot. Trench foot is an injury of the feet after prolonged exposure to wet and cold-related conditions. Trench foot occurs because wet feet lose heat faster than dry feet. To prevent heat loss, the body constricts blood vessels in the feet, and then the skin tissue begins to die. Symptoms of trench foot include reddening of the skin, numbness, leg cramps, swelling, tingling pain, blisters or ulcers, bleeding under the skin, and gangrene (e.g., foot turns purple, blue, or gray).

Frostbite. Frostbite is an injury caused by freezing of the skin and deeper tissues, resulting in the loss of feeling and color in the affected areas. Frostbite can permanently damage body tissues, and severe cases can lead to amputation. Examples of risk factors for frostbite include contact with metal or water, dehydration, diabetes, smoking, alcohol abuse, sedating or judgment impairing medications, and prior history of frostbite. Symptoms of frostbite include numbness; tingling or stinging; aching; and bluish or pale, waxy skin. During treatment of frostbite and trench foot, avoid rubbing or putting pressure on affected areas, since that can damage tissue.

Hypothermia. When exposed to cold temperatures, the body loses heat faster than it can be produced. Prolonged exposure to cold causes internal body temperature to drop, resulting in a condition called hypothermia. Hypothermia affects brain function, making the victim unable to think clearly or move well (i.e., they may be unable to protect themselves from hazards, or experience slips, trips, and falls). This makes hypothermia particularly dangerous because a person may not recognize the symptoms and will be unable to make life-preserving decisions. Symptoms of hypothermia can depend on how long a person has been exposed to cold temperatures and individual variability.

Hypothermia Symptoms and First Aid

Early symptoms include shivering, fatigue, loss of coordination, confusion, and/or disorientation.

Late symptoms include no shivering, blue skin, dilated pupils, slowed pulse and breathing, and/or loss of consciousness.

If hypothermia is suspected, medical assistance should be requested immediately (e.g., call 911). Begin first aid by:

1. moving the worker to a warm room or vehicle,
2. removing wet clothing,
3. covering their body with loose, dry blankets, clothing, or towels (may use skin-to-skin contact or warm bottles or hot packs in armpits, sides of chest, and groin to increase body's temperature), and
4. providing warm, non-alcoholic beverages if the worker is conscious.

If the worker has no pulse, cardiopulmonary resuscitation (CPR) should be provided and continued during the warming attempts, until the person responds or medical aid becomes available. Chest compressions should not be performed for patients who manifest an organized rhythm on a cardiac monitor (e.g., automated external defibrillator [AED]), even if they have no palpable pulses and no other signs of life. The worker should be handled very gently and kept horizontal, because when cold, the heart is prone to ventricular fibrillation with any disturbance. Severely hypothermic patients have been known to survive neurologically intact after long periods (over an hour) in a state of "suspended animation" [State of Alaska DHSS 2014].

Photo by ilkercelik/Getty Images

Case Reports

Indoor Environment: Airline Catering Facility

In an airline catering facility cold room (approximately 40°F), meals were assembled at workstations in shifts lasting 3–8 hours [Ceballos et al. 2015; NIOSH 2014]. Because preparations sometimes required fine manual dexterity (e.g., thinly slicing fish, decorating with small garnishes), the workers preferred wearing thin gloves instead of thicker, better insulated gloves. The frozen food they handled caused their hands to become cold and numb. Drafts inside the cold room made some areas feel colder than others, and air velocities exceeded the recommended guidelines of 200 feet per minute (FPM) [ACGIH 2019]. In addition, the workers felt that their breaks were not long enough to warm up, or to change out of wet or sweat-dampened clothing. An evaluation of the cold room concluded that thermal comfort concerns perceived by workers might have resulted from workstation air drafts, insufficient use of personal protective equipment (e.g., better insulated gloves) due to dexterity concerns, work practices, and lack of knowledge about good health and safety practices. In an evaluation of a second airline catering facility where the temperature was approximately 40°F, workers reported that they

felt discomfort working in cold temperatures, particularly in the freezer or coolers [NIOSH 2015]. The reported findings suggest that language was a barrier to effective training and communication regarding workplace safety and health because employees came from 18 countries.

Outdoor Environment: Long Haul Driving Along Highway

In the winter of 2009, a 56-year-old male truck driver went to the emergency room seeking care [Alaska Trauma Registry]. He had come to Alaska after a long haul drive through Canada. Along his route, he had stopped to change a fuel filter. He accidentally splashed diesel fuel on his gloves, which froze to his hands as he worked outside along the highway. After arriving at his destination, he had to spend a night at the hospital receiving treatment for his frostbitten hands.

Outdoor Environment: Sheep Ranch

At 3:00 p.m., a 58-year-old woman (who was wearing tennis shoes, blue jeans, sweater, jacket, and gloves) and her husband left their sheep ranch headquarters to round up their animals and bring them in for protection from a major snow storm that was developing [NIOSH 1990]. The woman separated from her husband to chase down a second flock of sheep. Shortly afterward, a high wind arose and created whiteout conditions in the area. The husband was unable to locate the woman and returned to the ranch to obtain additional help. At 10:00 p.m., the sheriff's department, local volunteer fire department, emergency medical service, and search and rescue units became involved in the search. The search continued until 3:00 a.m., when it was decided to wait for daylight. At 7:45 a.m., the body of the woman was found. Autopsy results showed she had died from hypothermia.

Recommendations

Whether in an indoor or outdoor environment where cold stress conditions are possible, employers and workers should be aware of symptoms of cold-related illness and injury, not only in themselves but also in their coworkers, and be prepared to immediately notify their supervisor, provide first aid, and seek prompt medical assistance (e.g., call 911).

Prevention is the best way to avoid cold-related illness and injury. Employers and workers should follow the NIOSH recommendations below to reduce the risk of cold-related illness and injury.

All Cold Environments

Employers should:

- Train supervisors and workers to prevent, recognize, and treat cold-related illness and injury.
- Provide training in a language and vocabulary that the workers understand.
- Reduce workers' time spent in the cold environment.
- Reduce the physical demands of workers (e.g., use relief workers or rotate extra workers in and out of work for long, demanding jobs).
- Ensure access to warm areas and a place to change out of wet clothes.
- Encourage employees to take breaks to warm up when needed.
- Monitor workers in cold conditions and initiate a buddy system.
- Include a medical and environmental thermometer and chemical hot packs in first aid kits.
- Participate in joint management/employee safety committees.
- Provide appropriate cold weather gear such as hats, gloves, and boots for work in cold environments.
- Provide wind protective clothing based on air velocities.
- Provide prompt medical attention to workers who show signs of cold-related illness or injury.

Workers should:

- Take regular breaks to warm up.
- Monitor their physical condition and that of coworkers.
- Stay hydrated by drinking lots of water; warm beverages may help increase body temperature.
- Stay well nourished by snacking on high carbohydrate foods.
- Avoid touching cold metal or wet surfaces with bare skin.

Photo by sorn340/Getty Images

- Report signs and symptoms of cold-related illness and injury to supervisors and medical staff immediately.
- Participate in joint management/employee safety committees.
- Carry extra cold weather gear, such as a change of clothes, in case work clothing gets wet.
- Wear several layers of loose clothing for better insulation; take layers off if you begin to sweat and put them back on when you cool down. Inner layers should be wool or synthetic fabrics to wick away moisture; outer layers should be wind and water-resistant.
- Avoid wearing wet clothes.
- Protect the ears, face, hands, and feet by wearing hats, gloves, socks, and boots.

Indoor Environments

Employers should:

- Install equipment to reduce drafts and condensation.
- Provide warm water or dry air heaters outside cold rooms for workers to warm their hands.
- Minimize air velocity and not exceed 200 FPM.
- Perform preventative maintenance on a regular schedule and make repairs if heating systems are not working properly.
- Rotate employees to different tasks after every break.
- Minimize work requiring manual dexterity in cold rooms.
- Provide glove alternatives for workers inside cold rooms (e.g., glove liners or fingerless gloves to wear under plastic gloves).

Photo by wabeno/Getty Images

Outdoor Environments

Employers should:

- Create a plan for assessing and acting on workplace hazards posed by sudden weather changes, such as dropping temperatures or increasing wind speeds.
- Schedule normal maintenance and repairs in cold areas for warmer months when possible.
- Schedule cold jobs for the warmer part of the day.
- Ensure that workers traveling through or working in remote areas have appropriate cold-weather survival equipment (e.g., emergency communications equipment such as a personal locator beacon or satellite phone).

Acknowledgments

The principal contributors to this publication were Brenda Jacklitsch, PhD, MS, of the NIOSH Division of Science Integration (DSI) and Diana Ceballos, PhD, MS, CIH, of the Harvard T.H. Chan School of Public Health (formerly with NIOSH).

Suggested Citation

NIOSH [2019]. Preventing cold-related illness, injury, and death among workers. By Jacklitsch B, Ceballos D. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. DHHS (NIOSH) Publication No. 2019-113, DOI: https://doi.org/10.26616/NIOSHPUB2019113.

References

ACGIH [2019]. TLVs® and BEIs® based on documentation of the threshold limit values for chemical substances and physical agents & biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

Alaska Trauma Registry, http://dhss.alaska.gov/dph Emergency/Pages/trauma/registry.aspx. Accessed November 2016.

Ceballos D, Mead K, Ramsey J [2015]. Recommendations to improve employee thermal comfort when working in 40°F refrigerated cold rooms. J Occup Environ Hyg *12*(9):D2216.

NIOSH [1990]. Wife of a sheep rancher was fatally injured while attempting to round up a flock of sheep. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Fatality Assessment and Control Evaluation (FACE) Investigation Report No. 90CO024.

NIOSH [2008]. NIOSH safety and health topic: cold stress. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, www.cdc.gov/niosh/topics/coldstress.

NIOSH [2010]. NIOSH fast facts: protecting yourself from cold stress. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and

Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2010–115, www.cdc.gov/niosh/docs/2010-115/pdfs/2010-115.pdf.

NIOSH [2014]. Health hazard evaluation report: evaluation of ergonomic risk factors, thermal exposures, and job stress at an airline catering facility. By Ramsey JG, Musolin K, Ceballos D, Wiegand D, Mead K. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH HHE Report No. 2011-0131-3221.

NIOSH [2015]. Health hazard evaluation report: evaluation of ergonomic risk factors, acute traumatic injuries, and occupational exposures at an airline catering facility. By Ramsey J, Kawamoto M, Ceballos D, Wiegand DM. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH HHE Report No. 2011-0131-3222.

OSHA [2014]. Emergency preparedness and response safety and health guidelines — cold stress guide. Washington, DC: U.S Department of Labor, Occupational Safety and Health Administration, https://www.osha.gov/SLTC/emergencypreparedness/guides/cold.html.

State of Alaska DHSS [2014]. Cold injuries guidelines. Juneau, AK: Department of Health and Social Services, Division of Public Health, Section of Emergency Programs, Emergency Medical Services (EMS) Program, http://dhss.alaska.gov/dph/Emergency/Documents/ems/documents/Alaska%20DHSS%20EMS%20Cold%20Injuries%20Guidelines%20June%202014.pdf.

For More Information

Information about ***Cold Stress*** can be found on the following website:

https://www.cdc.gov/niosh/topics/coldstress/

1-800-CDC-INFO (1-800-232-4636)
TTY: 1-888-232-6348
CDC/NIOSH INFO: cdc.gov/info | cdc.gov/niosh
Monthly *NIOSH eNews*: https://www.cdc.gov/niosh/eNews.

Mention of any company or product does not constitute endorsement by NIOSH. In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites.

This document is in the public domain and may be freely copied or reprinted. NIOSH encourages all readers of the *Workplace Solutions* to make them available to all interested employers and workers.

As part of the Centers for Disease Control and Prevention, NIOSH is the federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries. All ***Workplace Solutions*** are based on research studies that show how worker exposures to hazardous agents or activities can be significantly reduced.

DOI: https://doi.org/10.26616/NIOSHPUB2019113
DHHS (NIOSH) Publication No. 2019-113

September 2019

OSHA® FactSheet

Protecting Workers from the Effects of Heat

At times, workers may be required to work in hot environments for long periods. When the human body is unable to maintain a normal temperature, heat illnesses can occur and may result in death. It is also important to consider that hot work environments may exist indoors. This fact sheet provides information to employers on measures they should take to prevent worker illnesses and death caused by heat stress.

What is Heat Illness?

The following are illnesses that may result from exposure to heat in the workplace.

Heat Stroke is the most serious heat-related health problem. Heat stroke occurs when the body's temperature regulating system fails and body temperature rises to critical levels (greater than 104°F). ***This is a medical emergency that may result in death!*** The signs of heat stroke are confusion, loss of consciousness, and seizures. Workers experiencing heat stroke have a very high body temperature and may stop sweating. If a worker shows signs of possible heat stroke, ***get medical help immediately***, and call 911. Until medical help arrives, move the worker to a shady, cool area and remove as much clothing as possible. Wet the worker with cool water and circulate the air to speed cooling. Place cold wet cloths, wet towels or ice all over the body or soak the worker's clothing with cold water.

Occupational Factors that May Contribute to Heat Illness

- High temperature and humidity
- Low fluid consumption
- Direct sun exposure (with no shade) or extreme heat
- Limited air movement (no breeze or wind)
- Physical exertion
- Use of bulky protective clothing and equipment

Heat Exhaustion is the next most serious heat-related health problem. The signs and symptoms of heat exhaustion are headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy sweating and a body temperature greater than 100.4°F. Workers with heat exhaustion should be removed from the hot area and given liquids to drink. Cool the worker with cold compresses to the head, neck, and face or have the worker wash his or her head, face and neck with cold water. Encourage frequent sips of cool water. Workers with signs or symptoms of heat exhaustion should be taken to a clinic or emergency room for medical evaluation and treatment. Make sure that someone stays with the worker until help arrives. If symptoms worsen, call 911 and get help immediately.

Heat Cramps are muscle pains usually caused by the loss of body salts and fluid during sweating. Workers with heat cramps should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g., sports drinks) every 15 to 20 minutes.

Heat Rash is the most common problem in hot work environments. Heat rash is caused by sweating and looks like a red cluster of pimples or small blisters. Heat rash may appear on the neck, upper chest, groin, under the breasts and elbow creases. The best treatment for heat rash is to provide a cooler, less humid work environment. The rash area should be kept dry. Powder may be applied to increase comfort. Ointments and creams should ***not*** be used on a heat rash. Anything that makes the skin warm or moist may make the rash worse.

Prevention Made Simple: Program Elements

Heat Illness Prevention Program key elements include:

- A Person Designated to Oversee the Heat Illness Prevention Program
- Hazard Identification
- Water. Rest. Shade Message
- Acclimatization
- Modified Work Schedules
- Training
- Monitoring for Signs and Symptoms
- Emergency Planning and Response

Designate a Person to Oversee the Heat Stress Program

Identify someone trained in the hazards, physiological responses to heat, and controls. This person can develop, implement and manage the program.

Hazard Identification

Hazard identification involves recognizing heat hazards and the risk of heat illness due to high temperature, humidity, sun and other thermal exposures, work demands, clothing or PPE and personal risk factors.

Identification tools include: OSHA's Heat Smartphone App; a Wet Bulb Globe Thermometer (WBGT) which is a measure of heat stress in direct sunlight that takes into account temperature, humidity, wind speed, sun and cloud cover; and the National Weather Service Heat Index. Exposure to full sun can increase heat index values up to 15°F.

Water.Rest.Shade

Ensure that cool drinking water is available and easily accessible. (Note: Certain beverages, such as caffeine and alcohol can lead to dehydration.)

Encourage workers to drink a liter of water over one hour, which is about one cup every fifteen minutes.

Provide or ensure that fully shaded or air-conditioned areas are available for resting and cooling down.

Acclimatization

Acclimatization is a physical change that allows the body to build tolerance to working in the heat. It occurs by gradually increasing workloads and exposure and taking frequent breaks for water and rest in the shade. Full acclimatization may take up to 14 days or longer depending on factors relating to the individual, such as increased risk of heat illness due to certain medications or medical conditions, or the environment.

New workers and those returning from a prolonged absence should begin with 20% of the workload on the first day, increasing incrementally by no more than 20% each subsequent day.

During a rapid change leading to excessively hot weather or conditions such as a heat wave, even experienced workers should begin on the first day of work in excessive heat with 50% of the normal workload and time spent in the hot environment, 60% on the second day, 80% on day three, and 100% on the fourth day.

Modified Work Schedules

Altering work schedules may reduce workers' exposure to heat. For instance:

- Reschedule all non-essential outdoor work for days with a reduced heat index.
- Schedule the more physically demanding work during the cooler times of day;
- Schedule less physically demanding work during warmer times of the day;
- Rotate workers and split shifts, and/or add extra workers.
- Work/Rest cycles, using established industry guidelines.
- Stop work if essential control methods are inadequate or unavailable when the risk of heat illness is very high.

Keep in mind that very early starting times may result in increased fatigue. Also, early morning hours tend to have higher humidity levels.

Training

Provide training in a language and manner workers understand, including information on health effects of heat, the symptoms of heat illness, how and when to respond to symptoms, and how to prevent heat illness.

Monitoring for Heat Illness Symptoms

Establish a system to monitor and report the signs and symptoms listed on the previous page to improve early detection and action. Using a buddy system will assist supervisors when watching for signs of heat illness.

Emergency Planning and Response

Have an emergency plan in place and communicate it to supervisors and workers. Emergency plan considerations include:

- What to do when someone is showing signs of heat illness. This can make the difference between life and death.
- How to contact emergency help.
- How long it will take for emergency help to arrive and training workers on appropriate first-aid measures until help arrives.
- Consider seeking advice from a healthcare professional in preparing a plan.

Engineering Controls Specific to Indoor Workplaces

Indoor workplaces may be cooled by using air conditioning or increased ventilation, assuming that cooler air is available from the outside. Other methods to reduce indoor temperature include: providing reflective shields to redirect radiant heat, insulating hot surfaces, and decreasing water vapor pressure, e.g., by sealing steam leaks and keeping floors dry. The use of fans to increase the air speed over the worker will improve heat exchange between the skin surface and the air, unless the air temperature is higher than the skin temperature. However, increasing air speeds above 300 ft. per min. may actually have a warming effect. Industrial hygiene personnel can assess the degree of heat stress caused by the work environment and make recommendations for reducing heat exposure.

Additional information

For more information on this and other issues affecting workers or heat stress, visit: www.osha.gov/heat; www.cdc.gov/niosh/topics/heatstress; and www.noaa.gov/features/earthobs_0508/heat.html.

Workers have the right to working conditions that do not pose a risk of serious harm, to receive information and training about workplace hazards and how to prevent them, and to file a complaint with OSHA to inspect their workplace without fear of retaliation.

For more information about workers' rights, see OSHA's workers page at www.osha.gov/workers.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

U.S. Department of Labor

DTSEM FS-3743 08/2014

OSHA® QUICK CARD™

Protecting Workers from Heat Stress

Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions that can be taken any time temperatures are high and the job involves physical work.

Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Heavy physical labor
- No recent exposure to hot workplaces
- Low liquid intake
- Waterproof clothing

Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

To Prevent Heat Illness:

- Establish a complete heat illness prevention program.
- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.

U.S. Department of Labor

For more information:

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA 3154-06R 2017

OSHA® QUICK CARD™

- Modify work schedules and arrange frequent rest periods with water breaks in shaded or air-conditioned areas.
- Gradually increase workloads and allow more frequent breaks for workers new to the heat or those that have been away from work to adapt to working in the heat (acclimatization).
- Designate a responsible person to monitor conditions and protect workers who are at risk of heat stress.
- Consider protective clothing that provides cooling.

How to Protect Workers

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty. Drink water every 15 minutes.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.

What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.

U.S. Department of Labor

For more information:

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

To protect workers from falls, OSHA issued a final rule on Walking-Working Surfaces and Personal Fall Protection Systems on November 17, 2016. According to OSHA "fall hazards from heights and on working surfaces are one of the leading causes of serious workplace injuries and deaths, and the new rule more closely aligns general industry requirements with those in construction."

The rule updates and clarifies the walking-working surface standards, and adds clear training and inspection requirements.

In addition, all employees need to be aware of how to prevent slips, trips, and falls by following good housekeeping procedures and safe practices when they work on or around scaffolds, ladders, unprotected ledges or platforms, rooftops, open shafts, trapdoors, poles, towers, bridges, trestles, pits, or open tanks.

Below is information from OSHA, and although it doesn't pertain to GSI's line of work, you may find yourself in a situation in which knowing about this rule might be helpful.

Please read this the OSHA information and the summary from J.J. Keller so you are aware of the Walking-Working Standards and Slips-Trips-Falls.

The final rule will allow employers to select a fall protection system that works best for them from a range of accepted options that OSHA has permitted in construction since 1994, including:

- *Guardrail Systems*
- *Safety Net Systems*
- *Personal Fall Arrest Systems*
- *Positioning Systems*
- *Travel Restraint Systems*
- *Ladder Safety Systems*

One of the most significant changes will be to fixed and portable ladders and the safety requirements surrounding them. Cages and wells will no longer be acceptable forms of fall protection on fixed ladders higher than 24 feet, although employers will have a generous timeframe – up to 20 years in some cases – to phase in ladder safety systems or personal fall arrest systems (PFAS).

Alignment with Construction Standards

Because many employers perform activities that fall under both general industry and construction standards, the new final rule eases compliance by bringing many of the general industry standards in line with current construction standards.

More specifically, construction standards (29 CFR part 1926) are referred to in the following parts of the new Walking-Working Surfaces standard (29 CFR part 1910, subpart D):

- ***27(a) Scaffolds –*** *Scaffolds used in general industry must meet the requirements in construction 29 CFR part 1926, subpart L (Scaffolds).*

- ***28(b)(1)(ii) Unprotected sides and edges*** *– When the employer can demonstrate that it is not feasible or creates a greater hazard to use guardrail, safety net, or personal fall protection systems on residential roofs, the employer must develop and implement a fall protection plan that meets the requirements of construction 29 CFR 1926.502(k) and training that meets the requirements of 29 CFR 1926.503(a) and (c).*
- ***28(b)(12) Scaffolds and rope descent systems –*** *The employer must ensure: (i) Each employee on a scaffold is protected from falling in accordance 29 CFR part 1926, subpart L; and (ii) Each employee using a rope descent system 4 feet (1.2 m) or more above a lower level is protected from falling by a personal fall arrest system.*
- ***29(b) Guardrail systems Note to paragraph (b) of this section:*** *The criteria and practices requirement for guardrail systems on scaffolds are contained in 29 CFR part 1926, subpart L.*
- ***29(c) Safety net systems –*** *The employer must ensure each safety net system meets the requirements in 29 CFR part 1926, subpart M.*

Slips, Trips, and Falls and Walking Working Surface
An Overview provided by J.J. Keller

Overview

Slips, trips, and falls account for many industry accidents, and are responsible for 10 percent of all accidental deaths. They are also the fourth leading cause of fatalities (following motor vehicles, homicides, and being struck by objects or equipment).

Slips

Slips can be caused by wet surfaces, spills, or weather hazards such as ice or snow. Slips are more likely to occur when you hurry or run, wear the wrong kind of shoes, or don't pay attention to where you're walking.

You can help avoid slips by following these safety precautions:

- Practice safe walking skills. Take short steps on slippery surfaces to keep your center of balance under you, and point your feet slightly outward.
- Clean up or report spills right away. Even minor spills can be dangerous.
- Don't let grease accumulate at your work place.
- Be extra cautious on smooth surfaces such as newly waxed floors. Also be careful walking on loose carpeting.

Trips

Trips occur whenever your foot hits an object and you are moving with enough momentum to be thrown off balance. You can help avoid trips when you:

Make sure you can see where you are walking. Don't carry loads that you cannot see over.

Keep walking and working areas well lit, especially at night.

Keep the workplace clean and tidy. Store materials and supplies in the appropriate storage areas.

Properly maintain walking areas, and alert appropriate authorities regarding potential maintenance-related hazards.

Arrange furniture and office equipment so that it doesn't interfere with walkways or pedestrian traffic in your area.

Falls

To avoid falls consider the following measures:

- Don't jump off landings or loading docks. Use the stairs.
- Repair or replace stairs or handrails that are loose or broken.
- Keep passageways and aisles clear of clutter and well lit.
- Wear shoes with appropriate non-slip soles.

Hazards involved with using walking-working surfaces

The main hazards involved with walking and working surfaces include slips, trips, and falls. Stairways are taken for granted, and so become a source for accidents in the workplace.

What must my employer do?

Your employer is responsible for providing a safe working environment. That includes reducing or eliminating hazards in walking and working areas by doing the following:

Keep all employment, passageway, storerooms, and service rooms clean, orderly, and sanitary.

Maintain floors in clean, dry condition. If wet processes are used, drainage will be maintained. Gratings, mats, or raised platforms must be provided.

Keep floors, working places, and passageways free from protruding nails, splinters, or loose boards.

Keep aisles and passageways clear and in good repair with no obstructions that could create hazards.

Appropriately mark permanent aisles and passageways.

Maintain proper aisle width so passage or egress is not limited.

Provide covers and/or guardrails to protect employees from open pits, vats, tanks, ditches, and other hazards.

Follow load rating limits for all floors or roofs.

Maintain adequate lighting in areas to illuminate walking surfaces.

Provide handrails as required.

For GSI Field Work *(added in June 2019):*

Slips/Trips/Falls

Maintain good housekeeping standards and avoid leaving items on the ground where they could present a trip hazard. Set up adequate staging areas for all equipment needed. Inspect work area and level ground surface where possible.

Unstable/Uneven Terrain/Steep Grades/Elevated Surfaces

If there is a potential for falls because of unstable, steep surface, the buddy system and additional safety precautions should be developed and discussed with the GSI Health and Safety Coordinator. Before field work, perform reconnaissance and develop a plan for safe ingress and egress. Wear sturdy work boots.

Preventing Hearing Loss Caused by Chemical (Ototoxicity) and Noise Exposure

Safety and Health Information Bulletin

SHIB 03-08-2018
DHHS (NIOSH) Publication No. 2018-124

Introduction

Millions of workers are exposed to noise in the workplace every day and when uncontrolled, noise exposure may cause permanent hearing loss. Research demonstrates exposure to certain chemicals, called ototoxicants, may cause hearing loss or balance problems, regardless of noise exposure. Substances including certain pesticides, solvents, and pharmaceuticals that contain ototoxicants can negatively affect how the ear functions, causing hearing loss, and/or affect balance.

Source/Copyright: OSHA

The risk of hearing loss is increased when workers are exposed to these chemicals while working around elevated noise levels. This combination often results in hearing loss that can be temporary or permanent, depending on the level of noise, the dose of the chemical, and the duration of the exposure. This hearing impairment affects many occupations and industries, from machinists to firefighters.

Effects on Hearing

Harmful exposure to ototoxicants may occur through inhalation, ingestion, or skin absorption. Health effects caused by ototoxic chemicals vary based on exposure frequency, intensity, duration, workplace exposure to other hazards, and individual factors such as age. Effects may be temporary or permanent, can affect hearing sensitivity and result in a standard threshold shift. Since chemicals can affect central portions of the auditory system (e.g., nerves or nuclei in the central nervous system, the pathways to the brain or in the brain itself), not only do sounds need to be louder to be detected, but also they lose clarity. Specifically, speech discrimination dysfunction, the ability to hear voices separately from background noise, may occur and involve:

- Compressed loudness: sound distortion.
- Frequency resolution: the inability to differentiate two sounds with similar frequency.
- Temporal resolution: the inability to detect time gaps between sounds.
- Spatial resolution: the inability to localize sound.

Speech discrimination dysfunction can also make working in noisy environments difficult and increase the risk of workplace injuries due to an inability to hear co-workers, environmental sounds and warning signals.

There is growing concern among occupational health and safety professionals that ototoxicant-induced hearing loss may go unrecognized since the measure for hearing loss does not indicate the cause. For example, audiometric tests are powerful tools that show hearing impairments (i.e., threshold shifts); however, they do not differentiate between noise and ototoxic causes.

Hearing loss can be even greater with exposure to both ototoxic chemicals and noise than exposure to either noise or the ototoxic chemical alone.[1] Many ototoxic substances have a greater-than-additive (e.g., synergistic) effect on hearing loss with noise exposure and in particular with impulse noise.[2] Several studies have suggested that some ototoxic chemicals, such as certain solvents, might exacerbate noise-induced hearing loss even though the noise level is below OSHA's Permissible Exposure Limit (PEL).[3]

Combined exposure: health effects below the noise PEL

OSHA standards require employers to maintain exposure to the specific substance at or below the PEL. However, synergistic effects from the combined ototoxicant and noise exposure could result in hearing loss when exposures are below the PEL.

What are ototoxic chemicals and substances that contain ototoxicants?

Ototoxic chemicals are classified as neurotoxicants, cochleotoxicants, or vestibulotoxicants based on the part of the ear they damage, and they can reach the inner ear through the blood stream and cause injury to inner parts of the ear and connected neural pathways.[4] Neurotoxicants are ototoxic when they damage the nerve fibers that interfere with hearing and balance. Cochleotoxicants mainly affect the cochlear hair cells, which are the sensory receptors, and can impair the ability to hear. Vestibulotoxicants affect the hair cells on the spatial orientation and balance organs.[5] The research on ototoxicants and their interactions with noise is limited. The dose-response, lowest observed effect level (LOEL) and no observed effect level (NOEL) have been identified in animal experiments for only a few substances.[6]

The following table includes examples of ototoxic chemicals grouped by substance class.[7]

Substance Class	Chemicals
Pharmaceuticals ***Ototoxicity at therapeutic doses is limited***	Aminoglycosidic antibiotics (e.g. streptomycin, gentamycin) and some other antibiotics (e.g. tetracyclines), Loop diuretics* (e.g. furosemide, ethacrynic acid) Certain analgesics* and antipyretics* (salicylates, quinine, chloroquine) Certain antineoplastic agents (e.g. cisplatin, carboplatin, bleomycin).
Solvents	Carbon disulfide, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, styrene and methylstyrene, trichloroethylene.
Asphyxiants	Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke
Nitriles	3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotononitrile, 3,3'-iminodipropionitrile.
Metals and Compounds	Mercury compounds, germanium dioxide, organic tin compounds, lead.

Table: Selected Ototoxicants

The table does not identify all known toxicants and, in addition, there is limited evidence that supports the ototoxicity of other chemicals including cadmium, arsenic, bromates, halogenated hydrocarbons, insecticides, alkylic compounds, and manganese.

The exposure threshold for ototoxicity varies for each chemical based on its compound family, properties, exposure route, exposure concentration and duration, synergy with noise, and noise exposure, along with an individual's risk factors.

Which industries are more likely to have ototoxicants?

Industries that use potential ototoxicants include manufacturing, mining, utilities, construction, and agriculture. Manufacturing industry subsectors may include:

- Fabricated metal
- Machinery
- Leather and Allied Product
- Textile and Apparel
- Petroleum
- Paper
- Chemical (including Paint)
- Furniture and Related Product
- Transportation Equipment (e.g. Ship and Boat Building)
- Electrical Equipment, Appliance and Component (e.g., Batteries)
- Solar Cell

Occupational activities that often have high noise exposure and could add synergistic effects when combined with ototoxicant exposure (i.e., occurring in the above industries) may include:

- Printing
- Painting
- Construction
- Manufacturing occupations in the subsectors listed above
- Firefighting
- Weapons firing
- Pesticide spraying

When specific ototoxicity information is not available, information on the chemical's general toxicity, nephrotoxicity, and neurotoxicity may provide clues about the potential ototoxicity. Most chemicals that are known to affect the auditory system are also neurotoxic and/or nephrotoxic. Information on whether a chemical produces reactive free radicals could also give some clues about the agent's potential ototoxicity.

Prevention

The first step in preventing exposure to ototoxicants is to know if they are in the workplace. One way to identify ototoxicants in the workplace is by reviewing Safety Data Sheets (SDS) for ototoxic substances and/or chemicals, and ototoxic health hazards associated with ingredients in the product. For example, Figure 1 shows an SDS where ototoxicants may be in a product.

Section 11. Toxicological Information
Toxicological Information: Specific target organ toxicity – single exposure: Based on the concentration of this chemical in the mixture, the specific target organ toxicity – single exposure classification is a Category 1. Animal studies and human pharmacovigilance reports identify this chemical as a neurotoxicant.

Figure 1: Check the SDS.

Source/Copyright: OSHA

Employers must provide health and safety information as well as training to workers exposed to hazardous materials, including ototoxic chemicals (see OSHA's hazard communication standard at 29 CFR 1910.1200). The training must be in a language and vocabulary that the worker understands. Additionally, complaints from workers about hearing loss should include investigating SDSs for ototoxicants.

Controlling Exposure

Replacing a hazardous chemical with a less toxic chemical is an effective way to reduce exposure when ototoxicants are identified in the workplace.

If eliminating ototoxicants from the workplace is not possible, using engineering controls, such as isolation and enclosures to control exposure to ototoxicants and noise, may reduce risk for adverse health effects. Ventilation is also a recommended control method for ototoxicants.

Some administrative controls to consider include eliminating unnecessary tasks that cause noise or ototoxicant exposure, or operating noisy equipment when workers are not near.

Personal Protective Equipment (PPE)

Employers must assess and determine the appropriate PPE according to the general requirements in 29 CFR 1910.132, the respiratory protection requirements in 29 CFR 1910.134, and the hand protection requirements in 29 CFR 1910.138.

Since many ototoxic substances can be absorbed through the skin, chemical-protective gloves, arm sleeves, aprons and other appropriate clothing can assist in reducing dermal exposure.

OSHA's occupational noise exposure standard at 29 CFR 1910.95 only requires audiometric testing at the noise action level (i.e., an 85-decibel 8-hour time-weighted average). However, wearing hearing protection and using audiometric testing to detect early signs of hearing loss, even in workers exposed below the action level and ototoxic chemicals below the PEL, may prevent hearing loss from their synergistic effects.

Information on Hearing Loss Prevention programs and their effectiveness is available online from the National Institute for Occupational Safety and Health (NIOSH) at www.cdc.gov/niosh/topics/noise/preventhearingloss/hearlosspreventprograms.html.

Additional Information

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.

- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

Contact OSHA

Under the Act, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321- OSHA (6742), TTY 1-877-889-5627.

Contact NIOSH

To receive documents or more information about occupational safety and health topics, please contact NIOSH at 1-800-CDC-INFO (1-800-232-4636), TTY 1-888-232-6348, email: cdcinfo@cdc.gov or visit the NIOSH website at: www.cdc.gov/niosh.

---

[1] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 27.

[2] Campo P., Venet T., Thomas A., Cour C., Brochard C., Cosnier F. Neuropharmacological and cochleotoxic effects of styrene. Consequences on noise exposures. Neurotoxicol Teratol. 2014 Jul-Aug; 44:113-20.

[3] Occupational Safety and Health Administration. OSHA Technical Manual. Appendix D-3.

[4] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 9.

[5] Johnson, A.C. and T.C. Morata. Occupational exposure to chemicals and hearing impairment, in Arbete och Hälsa, The Nordic Expert Group, Editor. 2010: Gothenburg. p. 1. Available at http://hdl.handle.net/2077/23240

[6] European Agency for Safety and Health at Work. Combined Exposure to Noise and Ototoxic Substances. 2009. p 17.

[7] Morata T.C., Dunn D.E., Sieber W.K. Occupational exposure to noise and ototoxic organic solvents. Archives of Environmental Health, 1994; 49(5):359-365.

This Safety and Health Information Bulletin is not a standard or regulation, and it creates no new legal obligations. The Bulletin is advisory in nature, informational in content, and is intended to assist employers in providing a safe and healthful workplace. Pursuant to the *Occupational Safety and Health Act (OSH Act)*, employers must comply with hazard-specific safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, pursuant to Section 5(a)(1), the General Duty Clause of the Act, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement any recommendations in this Safety and Health Information Bulletin is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

FactSheet

Lightning Safety When Working Outdoors

Lightning strikes can severely injure or kill workers whose jobs involve working outdoors. Lightning is often overlooked as an occupational hazard, but employers need awareness about lightning hazards to ensure their workers' safety. This fact sheet provides employers and workers at outdoor worksites with lightning safety recommendations from the Occupational Safety and Health Administration (OSHA) and the National Oceanic and Atmospheric Administration (NOAA).

Introduction

Lightning is a dangerous natural force. Annually in the United States, cloud-to-ground lightning occurs 20 to 25 million times and over 300 people are struck by lightning. During the past 30 years, about 50 people, on average, have been killed by lightning strikes every year, and many more suffer permanent disabilities.

Precautions should be taken to prevent worker exposure to lightning. Employers should recognize lightning as an occupational hazard. Supervisors and workers at outdoor worksites should take lightning safety seriously.

Workers whose jobs involve working outdoors in open spaces, on or near tall objects, or near explosives or conductive materials (e.g., metal) have significant exposure to lightning risks. Worker activities at higher risk for lightning hazards include:

- Logging
- Explosives handling or storage
- Heavy equipment operation
- Roofing
- Construction (e.g., scaffolding)
- Building maintenance
- Power utility field repair
- Steel erection/telecommunications
- Farming and field labor
- Plumbing and pipe fitting
- Lawn services/landscaping
- Airport ground personnel operations
- Pool and beach lifeguarding

Photo: NOAA

Figure 1: Lightning strikes tall tree.

Reducing Lightning Hazards When Working Outdoors

Employers, supervisors, and workers should understand lightning risks, characteristics, and precautions to minimize workplace hazards. Lightning is unpredictable and can strike outside the heaviest rainfall areas or even up to 10 miles from any rainfall.

Many lightning victims are caught outside during a storm because they did not act promptly to get to a safe place, **or they go back outside too soon after a storm has passed**. If signs of approaching thunderstorms occur, workers should not begin any task they cannot quickly stop. Proper planning and safe practices can easily increase lightning safety when working outdoors.

When thunder roars, go indoors!

If you hear thunder, even a distant rumble, get to a safe place immediately.

Thunderstorms always include lightning. Any thunder you hear is caused by lightning!

NOAA advises that nowhere outside is safe when thunderstorms are in your area.

OSHA and NOAA recommend that employers and supervisors follow these lightning safety best practices for workers whose jobs involve working outdoors:

Check NOAA Weather Reports: Prior to beginning any outdoor work, employers and supervisors should check NOAA weather reports (weather.gov) and radio forecasts for all weather hazards. OSHA recommends that employers consider rescheduling jobs to avoid workers being caught outside in hazardous weather conditions. When working outdoors, supervisors and workers should continuously monitor weather conditions. Watch for darkening clouds and increasing wind speeds, which can indicate developing thunderstorms. Pay close attention to local television, radio, and Internet weather reports, forecasts, and emergency notifications regarding thunderstorm activity and severe weather.

Photo: NOAA

Figure 2: Lightning strikes a communications tower.

Seek Shelter in Buildings: Employers and supervisors should know and tell workers which buildings to go to after hearing thunder or seeing lightning. NOAA recommends seeking out fully enclosed buildings with electrical wiring and plumbing. Remain in the shelter for at least **30 minutes** after hearing the last sound of thunder.

Vehicles as Shelter: If safe building structures are not accessible, employers should guide workers to hard-topped metal vehicles with rolled up windows. Remain in the vehicle for at least **30 minutes** after hearing the last sound of thunder.

Phone Safety: After hearing thunder, do not use corded phones, except in an emergency. Cell phones and cordless phones may be used safely.

Emergency Action Plan

Employers should have a written Emergency Action Plan (EAP), as outlined in 29 CFR 1910.38 or 29 CFR 1926.35. The EAP should include a written lightning safety protocol for outdoor workers. This lightning safety protocol should:

- Inform supervisors and workers to take action after hearing thunder, seeing lightning, or perceiving any other warning signs of approaching thunderstorms.
- Indicate how workers are notified about lightning safety warnings.
- Identify locations and requirements for safe shelters.
- Indicate response times necessary for all workers to reach safe shelters.
- Specify approaches for determining when to suspend outdoor work activities, and when to resume outdoor work activities.
- Account for the time required to evacuate customers and members of the public, and the time needed for workers to reach safety.

Employers should also post information about lightning safety at outdoor worksites. All employees should be trained on how to follow the EAP, including the lightning safety procedures.

Photo: NOAA

Figure 3: Cranes are especially vulnerable to lightning.

What is lightning?

Lightning is a giant spark of electricity in the atmosphere between clouds or between a cloud and the ground.

Lightning can occur:

- Between the cloud and the ground (cloud-to-ground lightning)
- Within and between thunderstorm clouds (intra- and inter-cloud lightning)

For more information, see: www.nssl.noaa.gov/education/svrwx101/lightning/faq

Lightning Safety Training

Employers should adequately train all workers on lightning safety. Training should be provided for each outdoor worksite, so that supervisors and workers know in advance where a worksite's safe shelters are and the time it takes to reach them. Employers should train supervisors and workers to provide lightning safety warnings in sufficient time for everyone to reach a worksite's safe shelters and take other appropriate precautions.

Lightning Warning Systems

An employer's EAP may include lightning warning or detection systems, which can provide advance warning of lightning hazards. However, no systems can detect the "first strike," detect all lightning, or predict lightning strikes. NOAA recommends that employers first rely on NOAA weather reports, including NOAA Weather Radio All Hazards: www.nws.noaa.gov/nwr.

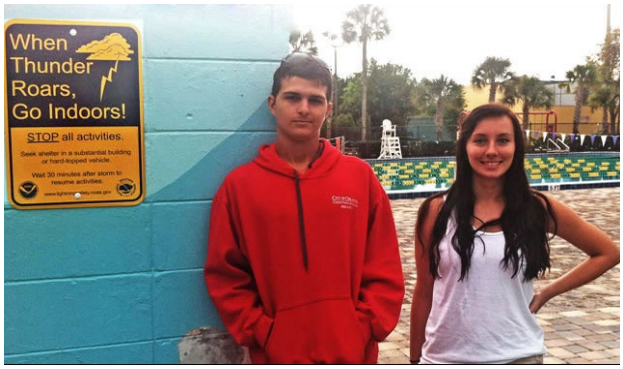


Photo: NOAA

Figure 4: Preparedness reduces lightning risks.

(For NOAA toolkits for organizations and large venues see: www.lightningsafety.noaa.gov/toolkits.shtml)

Commercial lightning detection and notification services are available to monitor for lightning activity. These notification services can send alerts when lightning activity develops or moves to within a certain range of a work site. In addition, these commercial systems can provide mapped locations of lightning strikes from an approaching storm. However, these systems cannot predict the first lightning strike. Consequently, it is important to watch the sky for storms developing overhead or nearby and get to a safe place prior to the first lightning strike.

Portable and hand-held lightning detectors function by detecting the electromagnetic signal from a nearby lightning strike and then processing the signal to estimate the distance to the lightning strike. These devices typically do not detect all strikes, cannot predict the first strike, cannot provide the location of a strike, and are less accurate than the commercial detection and notification systems. In some cases, simply listening for thunder or watching the sky may be a better indication of a developing or nearby storm.

For situations which require advance notice of thunderstorms, NOAA recommends monitoring forecasts and radar observations from either commercial weather services or NOAA to stay informed of changing weather conditions.

If Caught Outside in a Thunderstorm

If you find yourself caught outside during a thunderstorm, there may be nothing you can do to prevent being struck by lightning. There simply is no safe place outside in a thunderstorm. This is why it is very important to get to a safe place at the first signs of a thunderstorm. If you are caught outside follow NOAA's recommendations to decrease the risk of being struck.

- Lightning is likely to strike the tallest objects in a given area—you should not be the tallest object.
- Avoid isolated tall trees, hilltops, utility poles, cell phone towers, cranes, large equipment, ladders, scaffolding, or rooftops.
- Avoid open areas, such as fields. Never lie flat on the ground.
- Retreat to dense areas of smaller trees that are surrounded by larger trees, or retreat to low-lying areas (e.g., valleys, ditches) but watch for flooding.
- Avoid water, and immediately get out of and away from bodies of water (e.g., pools, lakes).

Water does not attract lightning, but it is an excellent conductor of electricity. For boating safety see NOAA PA 200252.

- Avoid wiring, plumbing, and fencing. Lightning can travel long distances through metal, which is an excellent conductor of electricity. Stay away from all metal objects, equipment, and surfaces that can conduct electricity.
- Do not shelter in sheds, pavilions, tents, or covered porches as they do not provide adequate protection from lightning.
- Seek fully-enclosed, substantial buildings with wiring and plumbing. In modern buildings, the *interior* wiring and plumbing will act as an earth ground. A building is a safe shelter as long as you are not in contact with anything that can conduct electricity (e.g., electrical equipment or cords, plumbing fixtures, corded phones). Do not lean against concrete walls or floors (which may have metal bars inside).

OSHA Standards

Under the General Duty Clause, Section 5(a)(1) of the *Occupational Safety and Health Act of 1970* (OSH Act), employers are required to provide their employees with a place of employment that "is free from recognizable hazards that are causing or likely to cause death or serious harm to employees." The courts have interpreted OSHA's general duty clause to mean that an employer has a legal obligation to provide a workplace free of conditions or activities that either the employer or industry recognizes as hazardous and that cause, or are likely to cause, death or serious physical harm to employees when there is a feasible method to abate the hazard. This includes lightning hazards that can cause death or serious bodily harm.

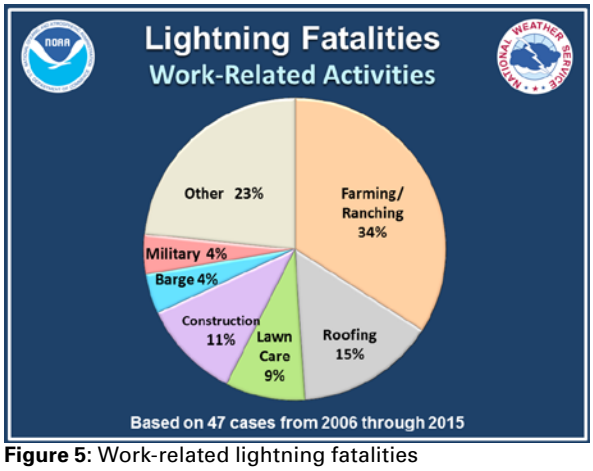


Figure 5: Work-related lightning fatalities

During storms or high winds, OSHA prohibits:

- work on or from scaffolds (29 CFR 1926.451(f)(12));
- crane hoists (29 CFR 1926.1431(k)(8)); and
- work on top of walls (29 CFR 1926.854(c)).

In these situations, scaffold work may continue only if a qualified person determines it is safe and personal fall protection or wind screens are provided. Crane hoists may continue only if a qualified person determines it is safe.

Helpful Resources

- NOAA Lightning Safety on the Job, www.lightningsafety.noaa.gov/job.shtml
- National Fire Protection Association (NFPA):
- *NFPA 780: Standard for the Installation of Lightning Protection Systems*, 2014 Edition, www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=780
- National Lightning Safety Institute, lightningsafety.com
- National Aeronautics and Space Administration (NASA), Global Hydrology Resource Center, Lightning and Atmospheric Electricity Research, thunder.msfc.nasa.gov
- Transportation Research Board of the National Academies,a*Protecting Airport Personnel from*
- *Lightning Strikes,* onlinepubs.trb.org/onlinepubs/acrp/acrp_iop_004.pdf

Contact NOAA

For information on lightning safety, or to obtain data, educational and outreach materials, and posters, visit NOAA's lightning safety website: www.lightningsafety.noaa.gov or the wrn program at noaa.gov/wrn. Contact NOAA at wrn.feedback@noaa.gov. Examples of data available from NOAA are provided below.

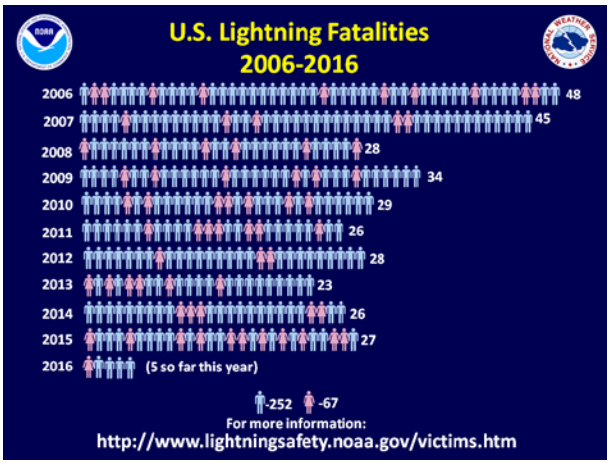


Figure 6: Annual lightning fatalities

Contact OSHA

For more information, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential compliant, or to request OSHA's free On-site Consultation Program services for small and medium-sized businesses, contact your nearest OSHA office, visit www.osha.gov, or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see OSHA's Workers page.

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA - DTSEM FS-3863 05/2016

ATTACHMENT 6

Novel Coronavirus Guidelines

Page left blank intentionally.

ATTACHMENT 6

COVID-19 Guidelines

Page intentionally left blank.

April 30, 2020

Hunter Young
Superfund and Emergency Management Division
U.S. Environmental Protection Agency
Oregon Operations Office
805 SW Broadway, Suite 500
Portland, OR 97205

RE: Compliance with CDC guidelines, EPA guidance, and Executive Order No. 20-12 during RM11E Field Activities

Mr. Young:

GSI Water Solutions, Inc. (GSI) can complete the full scope of work detailed in the River Mile 11E (RM11E) Phase I Remedial Design Sediment Sampling and Analysis Plan (SAP) (GSI/DOF, 2020) consistent within the CDC guidelines, EPA guidance, and Executive Order No. 20-12 issued by the Office of the Governor, State of Oregon. Attached are COVID-19 Guidelines for the RM11E field activities proposed in the SAP. These guidelines serve as an addendum to the Site-Specific Health and Safety Plan (HSP) submitted to the EPA as Appendix A of the SAP. The guidelines laid out in the addendum are meant to be adaptive in nature, so if additional measures to reduce the potential for exposure to COVID-19 are identified, they can be addressed. The geotechnical work is currently scheduled to begin in mid-May 2020 and the sediment characterization is scheduled to begin on June 1, 2020. In order to meet this schedule, we hope to receive approval for conducting this work from the EPA by Wednesday May 6, 2020.

If there are any questions or if you would like to discuss these guidelines, please do not hesitate to reach out.

Sincerely,

Dave Livesay
Principal Geologist
GSI Water Solutions, Inc.
55 SW Yamhill St., Suite 300
Portland, OR 97204

Page intentionally left blank.

DRAFT

Addendum to Site Specific Health and Safety Plans

COVID-19 Guidelines

RM11E

Portland, Oregon

May 2020

GSI Water Solutions, Inc.

Contents

SECTION 1: Introduction 3
1.1 COVID-19 3
1.2 Spreading COVID-19 3
1.3 Symptoms 3
1.4 Risk Factors in the Workplace 4
1.4.1 Lower Exposure Risk 4
1.4.2 Medium Exposure Risk 4
1.4.3 High Exposure Risk 5
SECTION 2: Safe Work Practices 6
2.1 Worker Training 6
2.2 Personnel Health Screening and Monitoring 6
2.3 Personal Sanitation 7
2.4 Field Facility Operations 7
2.4.1 Package and Supply Deliveries 8
2.4.2 Postings 8
2.5 Sick Policy 8
SECTION 3: Physical Distancing Practices 9
3.1 Physical Distancing on Boats 9
3.2 Physical Distancing in the Uplands and Field Facility 9
SECTION 4: Cleaning and Disinfection 11
4.1 Disinfecting Agents 11
4.2 Routine Cleaning 12
4.3 Contact Surfaces 12
4.4 Cutting/Samples/Cooler/Field Equipment Disinfection 13
4.5 Vehicle Use 13
SECTION 5: Personal Protective Equipment Considerations 14
SECTION 6: Identify and Isolate Suspected Cases 15
SECTION 7: Field and Safety Officer 16
SECTION 8: Signatures 17

Table

Table 1. EPA-Registered Household Disinfecting Agents 12

Attachments

Attachment 1 OSHA Guidance on Preparing Workplaces for COVID-19

SECTION 1: **Introduction**

The RM11E project is planning to conduct essential work during the coronavirus disease 2019 (COVID-19) pandemic. By implementing the guidelines described in this addendum to the RM11E Health and Safety Plan (HSP) work on the RM11E project can proceed with limited risks to workers and the public related to COVID-19. This introductory section provides background information on the COVID-19 virus which is important for all site workers to understand. The remaining sections include procedures specific to the RM11E project. A signature page is included at the end and all workers must sign this page to confirm they have read this document, understand the content, and will comply with the requirements established herein.

1.1 COVID-19

COVID-19 is not the same as the coronaviruses that commonly circulate among humans. COVID-19 is a novel (or new) coronavirus that has not previously been seen in humans. There are many types of human coronaviruses, including some that commonly cause mild upper-respiratory tract illnesses. Patients with COVID-19 can develop respiratory distress, fever, and other flu like symptoms, but they are not always symptomatic.

According to the U.S. Centers for Disease Control and Prevention (CDC) human infections with COVID-19 are present throughout the world, including in the United States and more specifically Portland, Oregon. This worldwide distribution of the virus led the World Health Organization (WHO) to designate COVID-19 as a pandemic on March 11, 2020. On March 8, 2020, Governor Kate Brown of Oregon declared a State of Emergency related to the COVID-19 pandemic. On March 13, 2020, the President of the United States declared the COVID-19 pandemic a national emergency. These declarations remain in place at this time.

1.2 Spreading COVID-19

COVID-19 appears to spread easily in a community ("community spread") and people may have been infected with the virus without knowing when or how they were exposed. Currently, there is an effort to better understand disease transmissibility, infectivity, and severity associated with COVID-19. According to the CDC:

- Transmission most likely occurs during close (within 6 feet) contact with an infected person.
- Transmission thought to occur mainly via droplets of respiratory secretions produced when an infected person coughs or sneezes, similar to how influenza spreads.
- Respiratory droplets from an infected person that contact others could transmit COVID-19.
- There is evidence that asymptomatic carriers of COVID-19 can actively transmit it to others.
- COVID-19 can be transmitted by contacting contaminated surfaces.

1.3 Symptoms

According to the United States Centers for Disease Control (CDC), reported illnesses have ranged from mild symptoms to severe illness and death for confirmed COVID-19 cases. Symptoms may appear 2–14 days after exposure based on the incubation period. Typical symptoms of COVID-19 include:

- Fever
- Cough
- Shortness of breath

In addition to these symptoms other indicators of a potential COVID-19 infection include the following:*

- Trouble breathing
- Persistent pain or pressure in the chest
- Loss of sense of taste or smell
- Confusion
- Bluish lips or face

*This list is not inclusive. Please consult your medical provider for any other symptoms that are severe or concerning.

If you develop any symptoms of COVID-19, get medical attention immediately. Self-quarantine (in your hotel if on travel) and report your medical situation to the Field Safety Officer (FSO) and Field Investigation Project Manager (PM).

1.4 Risk Factors in the Workplace

Risk factors for worker exposure to COVID-19 include:

- Job duties involving close (within 6 feet) contact with infected people or other sources of the virus. This includes close contact with coworkers, clients, and/or members of the general public.
- Social conditions, such as transmission in areas of high population density and frequent person-to-person contact, either in the community or in the workplace.
- Travel to areas highly affected by COVID-19 and gathering in large groups.

Exposure risks can increase for workers interacting with individuals at higher risk of contracting COVID-19 and for workers who have exposure to other sources of the virus outside of their job duties. Other factors, such as conditions in communities where employees live and work, their activities outside of work, and individual health conditions; may also affect workers' risk of getting COVID-19.

The U.S. Occupational Safety and Health Administration (OSHA) has developed guidance for classifying worker exposure risks into lower (caution), medium, high, and very high-risk categories and provides guidance and resources for protecting workers who perform job tasks in each risk level. Workers on the RM11E project all fall into the lower and medium exposure risk categories.

1.4.1 Lower Exposure Risk

Jobs that do not require contact with people. Workers in this category have minimal occupational contact with the public and other coworkers. Examples relevant to the RM11E project include the following:

- Remote workers (i.e., those working from home during the pandemic)
- Office workers who do not have frequent close contact with coworkers, customers, or the public
- Certain field facility workers who will be filling primarily administrative roles

1.4.2 Medium Exposure Risk

Jobs that require frequent/close contact with people who may or may not be infected, but who are not known to have or suspected of having COVID-19. Most of the field work on the RM11E project fall into this category and include the following:

- Workers who are in contact with the general public and family members with high exposure risk
- Those working with subcontractors.

- Those working near each other in the field facility

1.4.3 High Exposure Risk

COVID-19 is a new disease and there is limited information regarding risk factors for severe disease. Based on currently available information and clinical expertise, older adults and people of any age who have serious underlying medical conditions might be at higher risk for severe illness from COVID-19. Based upon available information to date, those at high-risk for severe illness from COVID-19 include the following:

- People aged 65 years and older
- People who live in a nursing home or long-term care facility
- Other high-risk conditions could include:
    - People with chronic lung disease or moderate to severe asthma.
    - People who have serious heart conditions.
    - People who are immunocompromised.
    - People of any age with severe obesity (body mass index [BMI] > 40)
    - People with underlying medical conditions
    - Women who are pregnant

People at high risk of severe illness from COVID-19 should not participate in activities on RM11E project. Additionally, those that live with a high-risk person should consider whether the risks posed by participating in the RM11E project work are acceptable.

SECTION 2: **Safe Work Practices**

The COVID-19 outbreak is an ongoing and continually changing health crisis which requires daily reviews of practices and work restrictions to ensure ongoing protectiveness. The primary source of information should be the CDC. https://www.cdc.gov/coronavirus/2019-nCoV/index.html. Guidance specific to EPA Region 10 activities which include the RM11E project have been prepared and considered. Supplemental or additional facts and information can be obtained through the Oregon Health Authority https://govstatus.egov.com/OR-OHA-COVID-19.

2.1 Worker Training

According to the Occupational Safety and Health Administration (OSHA) COVID-19 resource page (https://www.osha.gov/SLTC/covid-19/controlprevention.html#health), training is recommended for all workers with reasonably anticipated occupational exposure to COVID-19. This training will be performed for RM11E project workers and includes information on potential sources of exposure to the virus, the hazards associated with that exposure, and appropriate workplace protocols in place to prevent or reduce the likelihood of exposure. Training will also include information about how to isolate individuals with suspected or confirmed COVID-19, and where to report possible cases.

Workers required to use personal protective equipment (PPE) must be trained. This training includes the following:

- When to use PPE
- What PPE is necessary
- How to properly put on, use, and take off PPE
- How to properly dispose of or disinfect, inspect for damage, and maintain PPE
- The limitations of PPE
- Applicable standards including:
    - PPE (29 CFR 1910.132)
    - Eye and face protection (29 CFR 1910.133)
    - Hand protection (29 CFR 1910.138)
    - Respiratory protection (29 CFR 1910.134)

2.2 Personnel Health Screening and Monitoring

Personnel health screenings will be performed prior to starting work and daily on an individual basis to reduce the likelihood of people infected with COVID-19 from participating in the RM11E project. Screening consists of the following:

- Understand the community exposure and travel history of individuals and current conditions in Portland, Oregon within which the Project Area resides. If an employee has traveled to an affected country outside the US or has had exposure to individuals infected with COVID-19 (or being tested for COVID-19) within the US, we require a self-quarantine from the project for a minimum of 14 days. This will allow time for to symptoms develop or confirm through testing that they are not carriers of COVID-19. The following link provides the CDC list of countries to avoid non-essential travel. https://wwwnc.cdc.gov/travel/notice.
- Understand personal risk factors associated with contracting COVID-19 (see Section 1).
- Conduct daily health status screening. These screenings will not require that medical information be shared. Personnel will consider their current physical condition and assess whether they have recently experienced any symptoms of COVID-19 (e.g., fever, cough, shortness of breath, etc. [see Section 1]) and inform the FSO if they feel fit for duty.

- Non-contact temperature screening may be used.
- Personnel will not come to work if they have had close contact with someone diagnosed, or being tested for COVID-19 (family, friend, co-worker, first-line health worker etc.) or have had deployed to an area of high community spread of COVID-19 in past 14 days. In these cases, they must self-quarantine.

The FSO will document the results of the initial and daily screenings.

2.3 Personal Sanitation

To improve personal sanitation and reduce the likelihood of transmitting COVID-19 the following actions should be taken:

- Wash your hands often with soap and water for at least 20 seconds, especially after you have been in a public place, or after blowing your nose, coughing, or sneezing. Field teams should keep water and soap on the boat and in the upland facility. Dry hands using disposable, single-use paper towels or and immediately dispose of them.
- Use a hand sanitizer that contains at least 60 percent alcohol if soap and water are not available. Cover all surfaces of your hands and rub them together until they feel dry.
- Wear a face covering or surgical mask when working around others (within 6 feet).
- Avoid touching your eyes, nose, and mouth.
- Do not shake hands, use non-contact greetings.
- Cover your mouth and nose with a tissue or use the inside of your elbow when you cough or sneeze. Throw used tissues in the trash. Immediately wash your hands.
- Decontaminate all contact surfaces with an EPA-registered disinfectant at the start of each workday and when shared equipment is transferred between personnel.
- Use gloved hands when contacting surfaces or when transferring equipment between personnel is required. When putting on or removing gloves avoid touching the gloves' outer surfaces.
- Do not share PPE (face coverings, respirators, eyewear, Tyvek, etc.) or clothing. PPE will be issued to personnel for the duration of the response.
- Do not share food or drinking glasses or bottles.
- Pack meals instead of getting them out if possible.
- Prior to work, obtain EPA-registered disinfectants, soap, and hand sanitizer.
- Avoid overnight stays at lodging establishments to the extent practical.
- If staying in a hotel disinfect your rooms surfaces with an EPA-registered disinfectant. Use the No Housekeeping sign to limit entry to your room. Avoid hotel buffets and common meeting areas.

In addition to the considerations above, a linen service will supply and launder field clothing for all personnel on a regular basis. This action will help limit the potential for transmitting COVID-19 and reduce the potential for bringing contamination offsite.

2.4 Field Facility Operations

The following considerations should be taken when operating the field facility:

- Limit the number of staff in the field facility.
- Assign and mark positions in the field facility to provide adequate distance when not working.

- Roll up walls on tents when possible to allow for improved fresh air exchange.
- Deliver products through curbside pick-up or delivery.
- Set up larger (but fewer) deliveries and courier pickups.
- Limit the number of contact surfaces.
- Decontaminate contact surfaces often.
- When in an office, only have one worker occupy the room at a time.
- Use individually assigned clipboards and writing utensils. Do not share them.
- Efforts will be made to limit the sharing and use of clipboards.

The FSO will work to ensure that these considerations are taken into account.

2.4.1 Package and Supply Deliveries

When receiving business-critical deliveries, the person making the delivery will be asked to leave the package(s)/cooler(s) in an area where workers are not present. If a signature is required, the employee will ensure they remain at least 6 feet from the delivery driver and immediately wash their hands after contact. The receiving employee must also sanitize any hard non-porous surfaces of the delivery where potential contact with the package will be made.

2.4.2 Postings

Postings will be placed around the field facility detailing the support programs available for staying home when sick, how to cover your cough and sneeze, how to maintain personal sanitation, and emphasizing the need for physical distancing. For workers on boats, daily health and safety tailgate meetings will address these programs and practices.

2.5 Sick Policy

Daily health screenings will be conducted individually and documented by the FSO consistent with Section 2.2. It is critical that personnel DO NOT come to work if they are sick or are experiencing symptoms of COVID-19. If this occurs, inform the FSO and PM that you are feeling sick as soon as possible. Also, if you suspect possible COVID-19 symptoms, speak to your physician or medical provider to determine if you should be tested. Personnel who suspect they may have COVID-19 should self-quarantine until clearance is received from your health care provider. If tested, and a positive result is reported, inform GSI Human Resources and other people with whom you have recently been in close contact. Do not return to the work until medical clearance has been provided.

SECTION 3: **Physical Distancing Practices**

Physical distancing (maintaining >6 feet of space between workers and avoid exposure to particulates and droplets) practices should be adhered to when working with others on boats, in the uplands, or at the field facility during the RM11E project. By ensuring that these practices are implemented, the potential for transmission of COVID-19 can be limited. The FSO will oversee the adherence to physical distancing practices on boats, in the uplands, and within the field facility.

3.1 Physical Distancing on Boats

The following physical distancing actions should be taken when working with others on a boat:

- Keep a minimum of 6 feet from others. Typical practices may need to be modified and additional communications may be needed to support physical distancing.
- PPE including but not limited to face coverings or surgical masks, face shields, gloves, and goggles will be used if 6 feet of space cannot be maintained. More information about appropriate PPE is presented in Section 5.
- Limit the number of people on the boat.
- Limit the number of people in the cabin of the boat.
- Assign and mark positions on the deck of the boat to provide adequate distance when not working.

Other considerations include the following:

- Downsizing operations to limit the number of people onboard the boat.
- Add a barge at the base of the transfer pier to allow for increased physical distancing during idle periods.

3.2 Physical Distancing in the Uplands and Field Facility

The following physical distancing actions should be taken when working with others in the uplands or at the field facility:

- Keep a minimum of 6 feet from others. Typical practices may need to be modified and additional communications may be needed to support physical distancing.
- PPE including but not limited to face coverings or surgical masks, face shields, gloves, and goggles will be used if 6 feet of space cannot be maintained. More information about appropriate PPE is presented in Section 5.
- Take separate vehicles to the job site.
- Dedicate a single worker as the operator of the field vehicle. If the operator changes, fully sanitize the vehicle before handing the vehicle over and sanitize the vehicle at the end of each day.
- Use video, photographic, email, text messaging, or telephonic communication methods with other office personnel or field personnel working in different areas of the uplands.
- When in an office only have one worker occupy the room at a time.
- Minimize contact with paperwork.
- Limit the number of people in the field facility.
- Assign and mark positions in the field facility to provide adequate distance when not working.

Other considerations include the following:

- Implementing flexible meeting and travel options.
- Downsizing operations and limiting the number of staff in the uplands and at the field facility.

SECTION 4: **Cleaning and Disinfection**

When people touch a surface or object contaminated with the novel coronavirus, the virus that causes COVID-19, and then touch their own eyes, noses, or mouths, they may expose themselves to the virus. Early information suggests that COVID-19 can survive on certain types of surfaces for days. To mitigate the transmission risk posed by contaminated surfaces, cleaning and decontamination procedures will be implemented during the RM11E project. Cleaning and disinfection will be the responsibility of all personnel, but these tasks will also be part of the core responsibilities of the FSO.

4.1 Disinfecting Agents

Disinfecting refers to using chemicals to kill germs on surfaces. This process does not necessarily clean dirty surfaces or remove germs, but by killing germs on a surface after cleaning, disinfecting agents can lower the risk of transmitting COVID-19. The CDC provides instructions for environmental cleaning and disinfection for various types of work surfaces https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cleaning-disinfection.html. Employers operating workplaces during the COVID-19 pandemic should continue routine cleaning and other housekeeping practices in any facilities that remain open to workers or others. Employers who need to clean and disinfect environments potentially contaminated with the novel coronavirus should use EPA-registered disinfectants with label claims to be effective against COVID-19(also referred to as SARS-CoV-2). Products with EPA-approved emerging viral pathogens claims are expected to be effective against COVID-19 based on data for harder-to-kill viruses. https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2. EPA-registered household disinfecting agents are presented below in Table 1.

Table 1. EPA-Registered Household Disinfecting Agents

Common EPA-Registered Disinfectants and CDC guidelines				
Disinfectant Solution	Suggested Use	Contact Time	Pros	Cons
70% alcohol wipes	Sanitizing surfaces and equipment	5 minutes or until product evaporates	Easy to use, no mixing or diluting. Safe for use on equipment	Limited quantities. May go through a lot of wipes in a day
70% Isopropyl Alcohol Solution	Sanitizing surfaces and equipment	5 minutes or until product evaporates	Safe for use on equipment.	Flammability risk, expensive ingredients
Bleach in Water Solution	Sanitizing surfaces. Prepare a bleach solution by mixing: 5 tablespoons (1/3rd cup) bleach per gallon of water or 4 teaspoons bleach per quart of water *Note: Use in well-ventilated areas*	1 minute to 10 minutes and let air dry	Cheap, abundant quantities in region 10	Corrosive. Can be damaging to metal, plastic, and rubber surfaces. Can bleach porous materials. Not recommended for equipment. Longer process time with air drying. Incompatible with quaternary (ammonium containing) agents.

4.2 Routine Cleaning

Routine cleaning and disinfection (e.g., using EPA-registered disinfectants; see Table 1) of contact surfaces is necessary to manage the risks of transmitting COVID-19. Workers who conduct cleaning tasks must be protected from exposure to hazardous chemicals used in these tasks. In these cases, the PPE (29 CFR 1910 Subpart I) and Hazard Communication (29 CFR 1910.1200) standards may apply, and workers may need appropriate PPE to prevent exposure to chemicals. Do not use compressed air or water sprays to clean potentially contaminated surfaces, as these techniques may aerosolize infectious material.

4.3 Contact Surfaces

All contact surfaces (handrails, tables, fixtures, arm rests, seats, clipboards, touch screens, and door handles, etc.) will be disinfected on a frequent basis. The appropriate disinfecting agent will be selected and used in accordance with the instructions on the label. Wipe or spray down all surfaces with an appropriate disinfecting agent until sufficiently coated. Allow surfaces to dry.

4.4 Cutting/Samples/Cooler/Field Equipment Disinfection

Employees should disinfect all non-disposable materials, equipment, supplies, samples, and used coolers at the end of each workday, and more often as practical and appropriate. Wipe or spray down all surfaces with an appropriate disinfecting agent until sufficiently coated. Allow surfaces to dry. Wearing gloved hands, stage materials for future access by others.

4.5 Vehicle Use

Vehicle use has the potential to for exposing workers to COVID-19. To mitigate these risks, ensure adequate supplies of EPA-registered household disinfectant wipes (or other disinfectants as identified in Section 4.1) and disposable gloves are maintained in vehicles. Wipe or spray down all surfaces with an appropriate disinfecting agent until sufficiently coated. Allow surfaces to dry.

SECTION 5: **Personal Protective Equipment Considerations**

In general, the following PPE considerations should be made:

- PPE should be selected based on the ability of workers to maintain personal sanitation, support physical distancing, and reduce the contamination of contact surfaces.
- When disposable gloves are used, change them if they become torn or contaminated.
- When eye protection is needed, goggles and/or face shields will be used. Personal eyeglasses are not considered adequate eye protection for COVID-19.
- Face coverings or surgical masks will be used when 6 feet of distance cannot be maintained. N95 or similar masks may also be used and could further reduce the likelihood of transmission.
- If workers use respirators (including N95 or similar masks), they must be used in the context of a comprehensive respiratory protection program that meets the requirements of OSHA's Respiratory Protection standard (29 CFR 1910.134).
- The CDC provides strategies for optimizing the supply of PPE, including guidance on extended use during crises. If there are shortages of PPE items, they will be prioritized for high-hazard activities and for workers that will have the hardest time maintaining physical distance.
- PPE will not be shared among workers.

SECTION 6: **Identify and Isolate Suspected Cases**

Workers on the RM11E project may be exposed to COVID-19. Prompt identification and isolation of potentially infectious individuals is a critical to protecting others. If someone is known to have COVID-19, consider the following:

- Wherever feasible, immediately isolate individuals suspected of having COVID-19. For example, move potentially infectious individuals to a location away from workers, clients, and other visitors and with a closed door, if possible.
- Take steps to limit the spread of the individual's infectious respiratory droplets, by providing them a face covering or mask and asking them to wear it.
- Isolated individuals should leave work as soon as possible.
- Individuals determined to be carriers of COVID-19 may only return to working with others on the RM11E project after being self-quarantined for at least 14 days or until released for work by a healthcare professional.

SECTION 7: **Field and Safety Officer**

The FSO will perform COVID-19 specific health and safety audits throughout the field program to ensure that the guidelines in this addendum are being adhered to. Record of these audits will be made in field notebooks the FSO. The FSO will also work to decontaminate surfaces and adapt program operations to better reflect the objectives of the health screening, physical distancing, and decontamination protocols. If the FSO or any personnel feel the need to modify these practices, an activity hazard analysis will be prepared.

SECTION 8: **Signatures**

I have read, understood, and agree to abide by the requirements presented in this health and safety plan addendum. I understand that if I recognize an unsafe condition affecting my work, I have the absolute right to stop work until the condition is corrected.

Name Printed	Signature	Date

Page intentionally left blank.

ATTACHMENT 1

OSHA Guidance on Preparing Workplaces for COVID-19

Page intentionally left blank.

Guidance on Preparing Workplaces for COVID-19

OSHA 3990-03 2020

www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health."

This guidance is not a standard or regulation, and it creates no new legal obligations. It contains recommendations as well as descriptions of mandatory safety and health standards. The recommendations are advisory in nature, informational in content, and are intended to assist employers in providing a safe and healthful workplace. The Occupational Safety and Health Act requires employers to comply with safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm.

Material contained in this publication is in the public domain and may be reproduced, fully or partially, without permission. Source credit is requested but not required.

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

Guidance on Preparing Workplaces for COVID-19

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3990-03 2020

U.S. Department of Labor

Contents

Introduction 3

About COVID-19 4

How a COVID-19 Outbreak Could Affect Workplaces 6

Steps All Employers Can Take to Reduce
Workers' Risk of Exposure to SARS-CoV-2 7

Classifying Worker Exposure to SARS-CoV-2. 18

Jobs Classified at Lower Exposure Risk (Caution):
What to Do to Protect Workers 20

Jobs Classified at Medium Exposure Risk:
What to Do to Protect Workers 21

Jobs Classified at High or Very High Exposure Risk:
What to Do to Protect Workers 23

Workers Living Abroad or Travelling Internationally 25

For More Information 26

OSHA Assistance, Services, and Programs 27

OSHA Regional Offices 29

How to Contact OSHA 32

Introduction

Coronavirus Disease 2019 (COVID-19) is a respiratory disease caused by the SARS-CoV-2 virus. It has spread from China to many other countries around the world, including the United States. Depending on the severity of COVID-19's international impacts, outbreak conditions—including those rising to the level of a pandemic—can affect all aspects of daily life, including travel, trade, tourism, food supplies, and financial markets.

To reduce the impact of COVID-19 outbreak conditions on businesses, workers, customers, and the public, it is important for all employers to plan now for COVID-19. For employers who have already planned for influenza pandemics, planning for COVID-19 may involve updating plans to address the specific exposure risks, sources of exposure, routes of transmission, and other unique characteristics of SARS-CoV-2 (i.e., compared to pandemic influenza viruses). Employers who have not prepared for pandemic events should prepare themselves and their workers as far in advance as possible of potentially worsening outbreak conditions. Lack of continuity planning can result in a cascade of failures as employers attempt to address challenges of COVID-19 with insufficient resources and workers who might not be adequately trained for jobs they may have to perform under pandemic conditions.

The Occupational Safety and Health Administration (OSHA) developed this COVID-19 planning guidance based on traditional infection prevention and industrial hygiene practices. It focuses on the need for employers to implement engineering, administrative, and work practice controls and personal protective equipment (PPE), as well as considerations for doing so.

This guidance is intended for planning purposes. Employers and workers should use this planning guidance to help identify risk levels in workplace settings and to determine any appropriate control measures to implement. Additional guidance may be needed as COVID-19 outbreak conditions change, including as new information about the virus, its transmission, and impacts, becomes available.

The U.S. Department of Health and Human Services' Centers for Disease Control and Prevention (CDC) provides the latest information about COVID-19 and the global outbreak: www.cdc.gov/coronavirus/2019-ncov.

The OSHA COVID-19 webpage offers information specifically for workers and employers: www.osha.gov/covid-19.

This guidance is advisory in nature and informational in content. It is not a standard or a regulation, and it neither creates new legal obligations nor alters existing obligations created by OSHA standards or the *Occupational Safety and Health Act* (OSH Act). Pursuant to the OSH Act, employers must comply with safety and health standards and regulations issued and enforced either by OSHA or by an OSHA-approved State Plan. In addition, the OSH Act's General Duty Clause, Section 5(a)(1), requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. OSHA-approved State Plans may have standards, regulations and enforcement policies that are different from, but at least as effective as, OSHA's. Check with your State Plan, as applicable, for more information.

About COVID-19

Symptoms of COVID-19

Infection with SARS-CoV-2, the virus that causes COVID-19, can cause illness ranging from mild to severe and, in some cases, can be fatal. Symptoms typically include fever, cough, and shortness of breath. Some people infected with the virus have reported experiencing other non-respiratory symptoms. Other people, referred to as *asymptomatic cases*, have experienced no symptoms at all.

According to the CDC, symptoms of COVID-19 may appear in as few as 2 days or as long as 14 days after exposure.

How COVID-19 Spreads

Although the first human cases of COVID-19 likely resulted from exposure to infected animals, infected people can spread SARS-CoV-2 to other people.

The virus is thought to spread mainly from person-to-person, including:

- Between people who are in close contact with one another (within about 6 feet).
- Through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs.

Medium exposure risk jobs include those that require frequent and/or close contact with (i.e., within 6 feet of) other people who may be infected with SARS-CoV-2.

It may be possible that a person can get COVID-19 by touching a surface or object that has SARS-CoV-2 on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the primary way the virus spreads.

People are thought to be most contagious when they are most symptomatic (i.e., experiencing fever, cough, and/or shortness of breath). Some spread might be possible before people show symptoms; there have been reports of this type of asymptomatic transmission with this new coronavirus, but this is also not thought to be the main way the virus spreads.

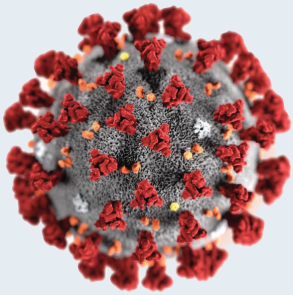
Although the United States has implemented public health measures to limit the spread of the virus, it is likely that some person-to-person transmission will continue to occur.

The CDC website provides the latest information about COVID-19 transmission: www.cdc.gov/coronavirus/2019-ncov/about/transmission.html.

How a COVID-19 Outbreak Could Affect Workplaces

Similar to influenza viruses, SARS-CoV-2, the virus that causes COVID-19, has the potential to cause extensive outbreaks. Under conditions associated with widespread person-to-person spread, multiple areas of the United States and other countries may see impacts at the same time. In the absence of a vaccine, an outbreak may also be an extended event. As a result, workplaces may experience:

- **Absenteeism.** Workers could be absent because they are sick; are caregivers for sick family members; are caregivers for children if schools or day care centers are closed; have at-risk people at home, such as immunocompromised family members; or are afraid to come to work because of fear of possible exposure.
- **Change in patterns of commerce.** Consumer demand for items related to infection prevention (e.g., respirators) is likely to increase significantly, while consumer interest in other goods may decline. Consumers may also change shopping patterns because of a COVID-19 outbreak. Consumers may try to shop at off-peak hours to reduce contact with other people, show increased interest in home delivery services, or prefer other options, such as drive-through service, to reduce person-to-person contact.
- **Interrupted supply/delivery.** Shipments of items from geographic areas severely affected by COVID-19 may be delayed or cancelled with or without notification.



This illustration, created at the Centers for Disease Control and Prevention (CDC), reveals ultrastructural morphology exhibited by the 2019 Novel Coronavirus (2019-nCoV). Note the spikes that adorn the outer surface of the virus, which impart the look of a corona surrounding the virion, when viewed electron microscopically. This virus was identified as the cause of an outbreak of respiratory illness first detected in Wuhan, China.

Photo: CDC / Alissa Eckert & Dan Higgins

Steps All Employers Can Take to Reduce Workers' Risk of Exposure to SARS-CoV-2

This section describes basic steps that every employer can take to reduce the risk of worker exposure to SARS-CoV-2, the virus that causes COVID-19, in their workplace. Later sections of this guidance—including those focusing on jobs classified as having low, medium, high, and very high exposure risks—provide specific recommendations for employers and workers within specific risk categories.

Develop an Infectious Disease Preparedness and Response Plan

If one does not already exist, develop an infectious disease preparedness and response plan that can help guide protective actions against COVID-19.

Stay abreast of guidance from federal, state, local, tribal, and/or territorial health agencies, and consider how to incorporate those recommendations and resources into workplace-specific plans.

Plans should consider and address the level(s) of risk associated with various worksites and job tasks workers perform at those sites. Such considerations may include:

- Where, how, and to what sources of SARS-CoV-2 might workers be exposed, including:
  - The general public, customers, and coworkers; and
  - Sick individuals or those at particularly high risk of infection (e.g., international travelers who have visited locations with widespread sustained (ongoing) COVID-19 transmission, healthcare workers who have had unprotected exposures to people known to have, or suspected of having, COVID-19).
- Non-occupational risk factors at home and in community settings.

- Workers' individual risk factors (e.g., older age; presence of chronic medical conditions, including immunocompromising conditions; pregnancy).
- Controls necessary to address those risks.

Follow federal and state, local, tribal, and/or territorial (SLTT) recommendations regarding development of contingency plans for situations that may arise as a result of outbreaks, such as:

- Increased rates of worker absenteeism.
- The need for social distancing, staggered work shifts, downsizing operations, delivering services remotely, and other exposure-reducing measures.
- Options for conducting essential operations with a reduced workforce, including cross-training workers across different jobs in order to continue operations or deliver surge services.
- Interrupted supply chains or delayed deliveries.

Plans should also consider and address the other steps that employers can take to reduce the risk of worker exposure to SARS-CoV-2 in their workplace, described in the sections below.

Prepare to Implement Basic Infection Prevention Measures

For most employers, protecting workers will depend on emphasizing basic infection prevention measures. As appropriate, all employers should implement good hygiene and infection control practices, including:

- Promote frequent and thorough hand washing, including by providing workers, customers, and worksite visitors with a place to wash their hands. If soap and running water are not immediately available, provide alcohol-based hand rubs containing at least 60% alcohol.
- Encourage workers to stay home if they are sick.
- Encourage respiratory etiquette, including covering coughs and sneezes.

- Provide customers and the public with tissues and trash receptacles.
- Employers should explore whether they can establish policies and practices, such as flexible worksites (e.g., telecommuting) and flexible work hours (e.g., staggered shifts), to increase the physical distance among employees and between employees and others if state and local health authorities recommend the use of social distancing strategies.
- Discourage workers from using other workers' phones, desks, offices, or other work tools and equipment, when possible.
- Maintain regular housekeeping practices, including routine cleaning and disinfecting of surfaces, equipment, and other elements of the work environment. When choosing cleaning chemicals, employers should consult information on Environmental Protection Agency (EPA)-approved disinfectant labels with claims against emerging viral pathogens. Products with EPA-approved emerging viral pathogens claims are expected to be effective against SARS-CoV-2 based on data for harder to kill viruses. Follow the manufacturer's instructions for use of all cleaning and disinfection products (e.g., concentration, application method and contact time, PPE).

Develop Policies and Procedures for Prompt Identification and Isolation of Sick People, if Appropriate

- Prompt identification and isolation of potentially infectious individuals is a critical step in protecting workers, customers, visitors, and others at a worksite.
- Employers should inform and encourage employees to self-monitor for signs and symptoms of COVID-19 if they suspect possible exposure.
- Employers should develop policies and procedures for employees to report when they are sick or experiencing symptoms of COVID-19.

- Where appropriate, employers should develop policies and procedures for immediately isolating people who have signs and/or symptoms of COVID-19, and train workers to implement them. Move potentially infectious people to a location away from workers, customers, and other visitors. Although most worksites do not have specific isolation rooms, designated areas with closable doors may serve as isolation rooms until potentially sick people can be removed from the worksite.
- Take steps to limit spread of the respiratory secretions of a person who may have COVID-19. Provide a face mask, if feasible and available, and ask the person to wear it, if tolerated. Note: A face mask (also called a surgical mask, procedure mask, or other similar terms) on a patient or other sick person should not be confused with PPE for a worker; the mask acts to contain potentially infectious respiratory secretions at the source (i.e., the person's nose and mouth).
- If possible, isolate people suspected of having COVID-19 separately from those with confirmed cases of the virus to prevent further transmission—particularly in worksites where medical screening, triage, or healthcare activities occur, using either permanent (e.g., wall/different room) or temporary barrier (e.g., plastic sheeting).
- Restrict the number of personnel entering isolation areas.
- Protect workers in close contact with (i.e., within 6 feet of) a sick person or who have prolonged/repeated contact with such persons by using additional engineering and administrative controls, safe work practices, and PPE. Workers whose activities involve close or prolonged/repeated contact with sick people are addressed further in later sections covering workplaces classified at medium and very high or high exposure risk.

Develop, Implement, and Communicate about Workplace Flexibilities and Protections

- Actively encourage sick employees to stay home.
- Ensure that sick leave policies are flexible and consistent with public health guidance and that employees are aware of these policies.
- Talk with companies that provide your business with contract or temporary employees about the importance of sick employees staying home and encourage them to develop non-punitive leave policies.
- Do not require a healthcare provider's note for employees who are sick with acute respiratory illness to validate their illness or to return to work, as healthcare provider offices and medical facilities may be extremely busy and not able to provide such documentation in a timely way.
- Maintain flexible policies that permit employees to stay home to care for a sick family member. Employers should be aware that more employees may need to stay at home to care for sick children or other sick family members than is usual.
- Recognize that workers with ill family members may need to stay home to care for them. See CDC's Interim Guidance for Preventing the Spread of COVID-19 in Homes and Residential Communities: www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-prevent-spread.html.
- Be aware of workers' concerns about pay, leave, safety, health, and other issues that may arise during infectious disease outbreaks. Provide adequate, usable, and appropriate training, education, and informational material about business-essential job functions and worker health and safety, including proper hygiene practices and the use of any workplace controls (including PPE). Informed workers who feel safe at work are less likely to be unnecessarily absent.

- Work with insurance companies (e.g., those providing employee health benefits) and state and local health agencies to provide information to workers and customers about medical care in the event of a COVID-19 outbreak.

Implement Workplace Controls

Occupational safety and health professionals use a framework called the "hierarchy of controls" to select ways of controlling workplace hazards. In other words, the best way to control a hazard is to systematically remove it from the workplace, rather than relying on workers to reduce their exposure. During a COVID-19 outbreak, when it may not be possible to eliminate the hazard, the most effective protection measures are (listed from most effective to least effective): engineering controls, administrative controls, safe work practices (a type of administrative control), and PPE. There are advantages and disadvantages to each type of control measure when considering the ease of implementation, effectiveness, and cost. In most cases, a combination of control measures will be necessary to protect workers from exposure to SARS-CoV-2.

In addition to the types of workplace controls discussed below, CDC guidance for businesses provides employers and workers with recommended SARS-CoV-2 infection prevention strategies to implement in workplaces: www.cdc.gov/coronavirus/2019-ncov/specific-groups/guidance-business-response.html.

Engineering Controls

Engineering controls involve isolating employees from work-related hazards. In workplaces where they are appropriate, these types of controls reduce exposure to hazards without relying on worker behavior and can be the most cost-effective solution to implement. Engineering controls for SARS-CoV-2 include:

- Installing high-efficiency air filters.
- Increasing ventilation rates in the work environment.
- Installing physical barriers, such as clear plastic sneeze guards.

- Installing a drive-through window for customer service.
- Specialized negative pressure ventilation in some settings, such as for aerosol generating procedures (e.g., airborne infection isolation rooms in healthcare settings and specialized autopsy suites in mortuary settings).

Administrative Controls

Administrative controls require action by the worker or employer. Typically, administrative controls are changes in work policy or procedures to reduce or minimize exposure to a hazard. Examples of administrative controls for SARS-CoV-2 include:

- Encouraging sick workers to stay at home.
- Minimizing contact among workers, clients, and customers by replacing face-to-face meetings with virtual communications and implementing telework if feasible.
- Establishing alternating days or extra shifts that reduce the total number of employees in a facility at a given time, allowing them to maintain distance from one another while maintaining a full onsite work week.
- Discontinuing nonessential travel to locations with ongoing COVID-19 outbreaks. Regularly check CDC travel warning levels at: www.cdc.gov/coronavirus/2019-ncov/travelers.
- Developing emergency communications plans, including a forum for answering workers' concerns and internet-based communications, if feasible.
- Providing workers with up-to-date education and training on COVID-19 risk factors and protective behaviors (e.g., cough etiquette and care of PPE).
- Training workers who need to use protecting clothing and equipment how to put it on, use/wear it, and take it off correctly, including in the context of their current and potential duties. Training material should be easy to understand and available in the appropriate language and literacy level for all workers.

Safe Work Practices

Safe work practices are types of administrative controls that include procedures for safe and proper work used to reduce the duration, frequency, or intensity of exposure to a hazard. Examples of safe work practices for SARS-CoV-2 include:

- Providing resources and a work environment that promotes personal hygiene. For example, provide tissues, no-touch trash cans, hand soap, alcohol-based hand rubs containing at least 60 percent alcohol, disinfectants, and disposable towels for workers to clean their work surfaces.
- Requiring regular hand washing or using of alcohol-based hand rubs. Workers should always wash hands when they are visibly soiled and after removing any PPE.
- Post handwashing signs in restrooms.

Personal Protective Equipment (PPE)

While engineering and administrative controls are considered more effective in minimizing exposure to SARS-CoV-2, PPE may also be needed to prevent certain exposures. While correctly using PPE can help prevent some exposures, it should not take the place of other prevention strategies.

Examples of PPE include: gloves, goggles, face shields, face masks, and respiratory protection, when appropriate. During an outbreak of an infectious disease, such as COVID-19, recommendations for PPE specific to occupations or job tasks may change depending on geographic location, updated risk assessments for workers, and information on PPE effectiveness in preventing the spread of COVID-19. Employers should check the OSHA and CDC websites regularly for updates about recommended PPE.

All types of PPE must be:

- Selected based upon the hazard to the worker.
- Properly fitted and periodically refitted, as applicable (e.g., respirators).

- Consistently and properly worn when required.
- Regularly inspected, maintained, and replaced, as necessary.
- Properly removed, cleaned, and stored or disposed of, as applicable, to avoid contamination of self, others, or the environment.

Employers are obligated to provide their workers with PPE needed to keep them safe while performing their jobs. The types of PPE required during a COVID-19 outbreak will be based on the risk of being infected with SARS-CoV-2 while working and job tasks that may lead to exposure.

Workers, including those who work within 6 feet of patients known to be, or suspected of being, infected with SARS-CoV-2 and those performing aerosol-generating procedures, need to use respirators:

- National Institute for Occupational Safety and Health (NIOSH)-approved, N95 filtering facepiece respirators or better must be used in the context of a comprehensive, written respiratory protection program that includes fit-testing, training, and medical exams. See OSHA's Respiratory Protection standard, 29 CFR 1910.134 at www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134.
- When disposable N95 filtering facepiece respirators are not available, consider using other respirators that provide greater protection and improve worker comfort. Other types of acceptable respirators include: a R/P95, N/R/P99, or N/R/P100 filtering facepiece respirator; an air-purifying elastomeric (e.g., half-face or full-face) respirator with appropriate filters or cartridges; powered air purifying respirator (PAPR) with high-efficiency particulate arrestance (HEPA) filter; or supplied air respirator (SAR). See CDC/NIOSH guidance for optimizing respirator supplies at: www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy.

- Consider using PAPRs or SARs, which are more protective than filtering facepiece respirators, for any work operations or procedures likely to generate aerosols (e.g., cough induction procedures, some dental procedures, invasive specimen collection, blowing out pipettes, shaking or vortexing tubes, filling a syringe, centrifugation).
- Use a surgical N95 respirator when both respiratory protection and resistance to blood and body fluids is needed.
- Face shields may also be worn on top of a respirator to prevent bulk contamination of the respirator. Certain respirator designs with forward protrusions (duckbill style) may be difficult to properly wear under a face shield. Ensure that the face shield does not prevent airflow through the respirator.
- Consider factors such as function, fit, ability to decontaminate, disposal, and cost. OSHA's Respiratory Protection eTool provides basic information on respirators such as medical requirements, maintenance and care, fit testing, written respiratory protection programs, and voluntary use of respirators, which employers may also find beneficial in training workers at: www.osha.gov/SLTC/etools/respiratory. Also see NIOSH respirator guidance at: www.cdc.gov/niosh/topics/respirators.
- Respirator training should address selection, use (including donning and doffing), proper disposal or disinfection, inspection for damage, maintenance, and the limitations of respiratory protection equipment. Learn more at: www.osha.gov/SLTC/respiratoryprotection.
- The appropriate form of respirator will depend on the type of exposure and on the transmission pattern of COVID-19. See the NIOSH "Respirator Selection Logic" at: www.cdc.gov/niosh/docs/2005-100/default.html or the OSHA "Respiratory Protection eTool" at www.osha.gov/SLTC/etools/respiratory.

Follow Existing OSHA Standards

Existing OSHA standards may apply to protecting workers from exposure to and infection with SARS-CoV-2.

While there is no specific OSHA standard covering SARS-CoV-2 exposure, some OSHA requirements may apply to preventing occupational exposure to SARS-CoV-2. Among the most relevant are:

- OSHA's Personal Protective Equipment (PPE) standards (in general industry, 29 CFR 1910 Subpart I), which require using gloves, eye and face protection, and respiratory protection. See: www.osha.gov/laws-regs/regulations/standardnumber/1910#1910_Subpart_I.
  - When respirators are necessary to protect workers or where employers require respirator use, employers must implement a comprehensive respiratory protection program in accordance with the Respiratory Protection standard (29 CFR 1910.134). See: www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134.
- The General Duty Clause, Section 5(a)(1) of the Occupational Safety and Health (OSH) Act of 1970, 29 USC 654(a)(1), which requires employers to furnish to each worker "employment and a place of employment, which are free from recognized hazards that are causing or are likely to cause death or serious physical harm." See: www.osha.gov/laws-regs/oshact/completeoshact.

OSHA's Bloodborne Pathogens standard (29 CFR 1910.1030) applies to occupational exposure to human blood and other potentially infectious materials that typically do not include respiratory secretions that may transmit SARS-CoV-2. However, the provisions of the standard offer a framework that may help control some sources of the virus, including exposures to body fluids (e.g., respiratory secretions) not covered by the standard. See: www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1030.

The OSHA COVID-19 webpage provides additional information about OSHA standards and requirements, including requirements in states that operate their own OSHA-approved State Plans, recordkeeping requirements and injury/illness recording criteria, and applications of standards related to sanitation and communication of risks related to hazardous chemicals that may be in common sanitizers and sterilizers. See: www.osha.gov/SLTC/covid-19/standards.html.

Classifying Worker Exposure to SARS-CoV-2

Worker risk of occupational exposure to SARS-CoV-2, the virus that causes COVID-19, during an outbreak may vary from very high to high, medium, or lower (caution) risk. The level of risk depends in part on the industry type, need for contact within 6 feet of people known to be, or suspected of being, infected with SARS-CoV-2, or requirement for repeated or extended contact with persons known to be, or suspected of being, infected with SARS-CoV-2. To help employers determine appropriate precautions, OSHA has divided job tasks into four risk exposure levels: very high, high, medium, and lower risk. The Occupational Risk Pyramid shows the four exposure risk levels in the shape of a pyramid to represent probable distribution of risk. Most American workers will likely fall in the lower exposure risk (caution) or medium exposure risk levels.

Occupational Risk Pyramid for COVID-19

Very High Exposure Risk

Very high exposure risk jobs are those with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures. Workers in this category include:

- Healthcare workers (e.g., doctors, nurses, dentists, paramedics, emergency medical technicians) performing aerosol-generating procedures (e.g., intubation, cough induction procedures, bronchoscopies, some dental procedures and exams, or invasive specimen collection) on known or suspected COVID-19 patients.
- Healthcare or laboratory personnel collecting or handling specimens from known or suspected COVID-19 patients (e.g., manipulating cultures from known or suspected COVID-19 patients).
- Morgue workers performing autopsies, which generally involve aerosol-generating procedures, on the bodies of people who are known to have, or suspected of having, COVID-19 at the time of their death.

High Exposure Risk

High exposure risk jobs are those with high potential for exposure to known or suspected sources of COVID-19. Workers in this category include:

- Healthcare delivery and support staff (e.g., doctors, nurses, and other hospital staff who must enter patients' rooms) exposed to known or suspected COVID-19 patients. (Note: when such workers perform aerosol-generating procedures, their exposure risk level becomes *very high.*)
- Medical transport workers (e.g., ambulance vehicle operators) moving known or suspected COVID-19 patients in enclosed vehicles.
- Mortuary workers involved in preparing (e.g., for burial or cremation) the bodies of people who are known to have, or suspected of having, COVID-19 at the time of their death.

Medium Exposure Risk

Medium exposure risk jobs include those that require frequent and/or close contact with (i.e., within 6 feet of) people who may be infected with SARS-CoV-2, but who are not known or suspected COVID-19 patients. In areas without ongoing community transmission, workers in this risk group may have frequent contact with travelers who may return from international locations with widespread COVID-19 transmission. In areas where there *is* ongoing community transmission, workers in this category may have contact with the general public (e.g., schools, high-population-density work environments, some high-volume retail settings).

Lower Exposure Risk (Caution)

Lower exposure risk (caution) jobs are those that do not require contact with people known to be, or suspected of being, infected with SARS-CoV-2 nor frequent close contact with (i.e., within 6 feet of) the general public. Workers in this category have minimal occupational contact with the public and other coworkers.

Jobs Classified at Lower Exposure Risk (Caution): What to Do to Protect Workers

For workers who do not have frequent contact with the general public, employers should follow the guidance for "Steps All Employers Can Take to Reduce Workers' Risk of Exposure to SARS-CoV-2," on page 7 of this booklet and implement control measures described in this section.

Engineering Controls

Additional engineering controls are not recommended for workers in the lower exposure risk group. Employers should ensure that engineering controls, if any, used to protect workers from other job hazards continue to function as intended.

Administrative Controls

- Monitor public health communications about COVID-19 recommendations and ensure that workers have access to that information. Frequently check the CDC COVID-19 website: www.cdc.gov/coronavirus/2019-ncov.
- Collaborate with workers to designate effective means of communicating important COVID-19 information.

Personal Protective Equipment

Additional PPE is not recommended for workers in the lower exposure risk group. Workers should continue to use the PPE, if any, that they would ordinarily use for other job tasks.

Jobs Classified at Medium Exposure Risk: What to Do to Protect Workers

In workplaces where workers have medium exposure risk, employers should follow the guidance for "Steps All Employers Can Take to Reduce Workers' Risk of Exposure to SARS-CoV-2," on page 7 of this booklet and implement control measures described in this section.

Engineering Controls

- Install physical barriers, such as clear plastic sneeze guards, where feasible.

Administrative Controls

- Consider offering face masks to ill employees and customers to contain respiratory secretions until they are able leave the workplace (i.e., for medical evaluation/care or to return home). In the event of a shortage of masks, a reusable face shield that can be decontaminated may be an acceptable method of protecting against droplet transmission. See CDC/NIOSH guidance for optimizing respirator supplies, which discusses the use of surgical masks, at: www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy.

- Keep customers informed about symptoms of COVID-19 and ask sick customers to minimize contact with workers until healthy again, such as by posting signs about COVID-19 in stores where sick customers may visit (e.g., pharmacies) or including COVID-19 information in automated messages sent when prescriptions are ready for pick up.
- Where appropriate, limit customers' and the public's access to the worksite, or restrict access to only certain workplace areas.
- Consider strategies to minimize face-to-face contact (e.g., drive-through windows, phone-based communication, telework).
- Communicate the availability of medical screening or other worker health resources (e.g., on-site nurse; telemedicine services).

Personal Protective Equipment (PPE)

When selecting PPE, consider factors such as function, fit, decontamination ability, disposal, and cost. Sometimes, when PPE will have to be used repeatedly for a long period of time, a more expensive and durable type of PPE may be less expensive overall than disposable PPE. Each employer should select the combination of PPE that protects workers specific to their workplace.

Workers with medium exposure risk may need to wear some combination of gloves, a gown, a face mask, and/or a face shield or goggles. PPE ensembles for workers in the medium exposure risk category will vary by work task, the results of the employer's hazard assessment, and the types of exposures workers have on the job.

High exposure risk jobs are those with high potential for exposure to known or suspected sources of COVID-19.

Very high exposure risk jobs are those with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures that involve aerosol generation or specimen collection/handling.

In rare situations that would require workers in this risk category to use respirators, see the PPE section beginning on page 14 of this booklet, which provides more details about respirators. For the most up-to-date information, visit OSHA's COVID-19 webpage: www.osha.gov/covid-19.

Jobs Classified at High or Very High Exposure Risk: What to Do to Protect Workers

In workplaces where workers have high or very high exposure risk, employers should follow the guidance for "Steps All Employers Can Take to Reduce Workers' Risk of Exposure to SARS-CoV-2," on page 7 of this booklet and implement control measures described in this section.

Engineering Controls

- Ensure appropriate air-handling systems are installed and maintained in healthcare facilities. See "Guidelines for Environmental Infection Control in Healthcare Facilities" for more recommendations on air handling systems at: www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm.
- CDC recommends that patients with known or suspected COVID-19 (i.e., person under investigation) should be placed in an airborne infection isolation room (AIIR), if available.
- Use isolation rooms when available for performing aerosol-generating procedures on patients with known or suspected COVID-19. For postmortem activities, use autopsy suites or other similar isolation facilities when performing aerosol-generating procedures on the bodies of people who are known to have, or suspected of having, COVID-19 at the time of their death. See the CDC postmortem guidance at: www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-postmortem-specimens.html. OSHA also provides guidance for postmortem activities on its COVID-19 webpage: www.osha.gov/covid-19.

- Use special precautions associated with Biosafety Level 3 when handling specimens from known or suspected COVID-19 patients. For more information about biosafety levels, consult the U.S. Department of Health and Human Services (HHS) "Biosafety in Microbiological and Biomedical Laboratories" at www.cdc.gov/biosafety/publications/bmbl5.

Administrative Controls

If working in a healthcare facility, follow existing guidelines and facility standards of practice for identifying and isolating infected individuals and for protecting workers.

- Develop and implement policies that reduce exposure, such as cohorting (i.e., grouping) COVID-19 patients when single rooms are not available.
- Post signs requesting patients and family members to immediately report symptoms of respiratory illness on arrival at the healthcare facility and use disposable face masks.
- Consider offering enhanced medical monitoring of workers during COVID-19 outbreaks.
- Provide all workers with job-specific education and training on preventing transmission of COVID-19, including initial and routine/refresher training.
- Ensure that psychological and behavioral support is available to address employee stress.

Safe Work Practices

- Provide emergency responders and other essential personnel who may be exposed while working away from fixed facilities with alcohol-based hand rubs containing at least 60% alcohol for decontamination in the field.

Personal Protective Equipment (PPE)

Most workers at high or very high exposure risk likely need to wear gloves, a gown, a face shield or goggles, and either a face mask or a respirator, depending on their job tasks and exposure risks.

Those who work closely with (either in contact with or within 6 feet of) patients known to be, or suspected of being, infected with SARS-CoV-2, the virus that causes COVID-19, should wear respirators. In these instances, see the PPE section beginning on page 14 of this booklet, which provides more details about respirators. For the most up-to-date information, also visit OSHA's COVID-19 webpage: www.osha.gov/covid-19.

PPE ensembles may vary, especially for workers in laboratories or morgue/mortuary facilities who may need additional protection against blood, body fluids, chemicals, and other materials to which they may be exposed. Additional PPE may include medical/surgical gowns, fluid-resistant coveralls, aprons, or other disposable or reusable protective clothing. Gowns should be large enough to cover the areas requiring protection. OSHA may also provide updated guidance for PPE use on its website: www.osha.gov/covid-19.

NOTE: Workers who dispose of PPE and other infectious waste must also be trained and provided with appropriate PPE.

The CDC webpage "Healthcare-associated Infections" (www.cdc.gov/hai) provides additional information on infection control in healthcare facilities.

Workers Living Abroad or Travelling Internationally

Employers with workers living abroad or traveling on international business should consult the "Business Travelers" section of the OSHA COVID-19 webpage (www.osha.gov/covid-19), which also provides links to the latest:

- CDC travel warnings: www.cdc.gov/coronavirus/2019-ncov/travelers
- U.S. Department of State (DOS) travel advisories: travel.state.gov

Employers should communicate to workers that the DOS cannot provide Americans traveling or living abroad with medications or supplies, even in the event of a COVID-19 outbreak.

As COVID-19 outbreak conditions change, travel into or out of a country may not be possible, safe, or medically advisable. It is also likely that governments will respond to a COVID-19 outbreak by imposing public health measures that restrict domestic and international movement, further limiting the U.S. government's ability to assist Americans in these countries. It is important that employers and workers plan appropriately, as it is possible that these measures will be implemented very quickly in the event of worsening outbreak conditions in certain areas.

More information on COVID-19 planning for workers living and traveling abroad can be found at: www.cdc.gov/travel.

For More Information

Federal, state, and local government agencies are the best source of information in the event of an infectious disease outbreak, such as COVID-19. Staying informed about the latest developments and recommendations is critical, since specific guidance may change based upon evolving outbreak situations.

Below are several recommended websites to access the most current and accurate information:

- Occupational Safety and Health Administration website: www.osha.gov
- Centers for Disease Control and Prevention website: www.cdc.gov
- National Institute for Occupational Safety and Health website: www.cdc.gov/niosh

OSHA Assistance, Services, and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their safety and health program.

Establishing a Safety and Health Program

Safety and health programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers.

Visit www.osha.gov/safetymanagement for more information.

Compliance Assistance Specialists

OSHA compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources.

Visit www.osha.gov/complianceassistance/cas or call 1-800-321-OSHA (6742) to contact your local OSHA office.

No-Cost On-Site Safety and Health Consultation Services for Small Business

OSHA's On-Site Consultation Program offers no-cost and confidential advice to small and medium-sized businesses in all states, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations.

For more information or to find the local On-Site Consultation office in your state, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/cooperativeprograms.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. Through the Alliance Program, OSHA works with groups to develop compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in the private sector and federal agencies who have implemented effective safety and health programs and maintain injury and illness rates below the national average for their respective industries.

Occupational Safety and Health Training

OSHA partners with 26 OSHA Training Institute Education Centers at 37 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials to assist employers and workers in finding and preventing workplace hazards.

All OSHA publications are free at www.osha.gov/publications and www.osha.gov/ebooks. You can also call 1-800-321-OSHA (6742) to order publications.

Employers and safety and health professionals can sign-up for *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist in finding and preventing workplace hazards. To sign up, visit www.osha.gov/quicktakes.

OSHA Regional Offices

Region 1
Boston Regional Office
(CT*, ME*, MA, NH, RI, VT*)
JFK Federal Building
25 New Sudbury Street, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region 2
New York Regional Office
(NJ*, NY*, PR*, VI*)
Federal Building
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region 3
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West, Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region 4
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region 5
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
John C. Kluczynski Federal Building
230 South Dearborn Street, Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region 6
Dallas Regional Office
(AR, LA, NM*, OK, TX)
A. Maceo Smith Federal Building
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax

Region 7
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region 8
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region 9
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa,
Guam and the Northern Mariana Islands)
San Francisco Federal Building
90 7th Street, Suite 2650
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region 10
Seattle Regional Office
(AK*, ID, OR*, WA*)
Fifth & Yesler Tower
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

*These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, Maine, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

APPENDIX B

Quality Assurance Project Plan

This page intentionally left blank.

Appendix B

Quality Assurance Project Plan

Phase I Remedial Design Investigation
River Mile 11 East
Portland, Oregon

May 2020

Prepared for

RM11E Group

Prepared by

GSI Water Solutions, Inc.

This page intentionally left blank

Project Approvals and Distribution List

Project Approvals

Title	Name/Organization	Signature	Date
Remedial Project Manager	Hunter Young/ EPA Region 10		
River Mile 11 East Group Project Coordinator	Jacqueline Thiell Wetzsteon/PacifiCorp		May 18, 2020
Remedial Design Program Manager	Paul Fuglevand, PE Dalton, Olmsted, Fuglevand, Inc. (DOF)		May 14, 2020
Field Investigation Project Director	Dave Livesay, RG/GSI Water Solutions, Inc. (GSI)		May 18, 2020
Field Investigation Project Manager	Alison Clements/GSI		May 18, 2020
Sampling and Analysis Coordinator	Benjamin Johnson/GSI		May 18, 2020
Chemistry QA Manager	James Mc Ateer/ QA/Q Solutions, LLC		May 18, 2020
Data Management	Elysse Alexander/GSI		May 18, 2020
Primary Laboratory Project Manager	Lisa Domenighini / APEX Laboratories, LLC		May 18, 2020

Distribution List

Organization	Contact
U.S. Environmental Protection Agency, Region 10	Hunter Young
Oregon Department of Environmental Quality	Madi Novak
Cargill, Inc.	Bill Ford
CBS Corporation	Jeff Groy
City of Portland	Cindy Ryals
DIL Trust	Michael Romey
Glacier Northwest, Inc.	Bryan Wigginton
PacifiCorp	Jacqueline Thiell Wetzsteon
State of Oregon – DSL	Richard Fitzgerald
DOF	Paul Fuglevand
GSI	Dave Livesay
GSI	Alison Clements
QA/QC Solutions, LLC	James Mc Ateer
APEX Laboratories, LLC	Lisa Domenighini

Contents

1. Introduction 1
   1.1 Data Quality Objectives 1
   1.2 Project Schedule 3
   1.3 Project Organization 3
   1.4 Special Training/Certification 4
   1.5 Documents and Records 4
      1.5.1 Field Documentation 4
      1.5.2 Laboratory Documentation 5
      1.5.3 Data Quality Documentation 6
2. Data Generation and Acquisition 7
   2.1 Sampling Process Design and Methodology 7
      2.1.1 Surface Sediments – Areas 1 through 5 7
      2.1.2 Subsurface Sediments Tiered Analytical Program – Areas 1, 2, 3, and 4 7
      2.1.3 Subsurface Sediments – Area 6 7
   2.2 Field QC Samples 8
      2.2.1 Split Samples 8
      2.2.2 Rinsate Blanks 8
      2.2.3 Trip Blanks 8
      2.2.4 Temperature Blanks 9
   2.3 Sample Handling, Custody, and Transport 9
   2.4 Corrective Actions 9
3. Bulk Sediment Testing 11
   3.1 TCLP Testing for Disposal Characterization 11
   3.2 DRET Testing 12
   3.3 Treatability Testing 12
      3.3.1 Jar Testing 12
      3.3.2 Water Clarification Testing 13
   3.4 Bench Tests for Stabilization and Handling 13
4. Laboratory Analysis and QA/QC 15
   4.1 Data Quality Indicators 15
      4.1.1 Precision 15
      4.1.2 Accuracy 16

4.1.3 Representativeness 16
4.1.4 Comparability 16
4.1.5 Completeness 16
4.1.6 Sensitivity 17
4.2 Laboratory QA/QC Procedures 17
4.3 Sample Preparation Protocols 18
4.3.1 Standard Laboratory Preparation Method for Chemical Analysis 18
4.3.2 Area 6 – Air Dry, Sieve, Analysis of Finer-Grained Fraction 18
4.4 Instrument and Equipment Testing, Inspection, and Maintenance 19
4.5 Instrument/Equipment Calibration and Frequency 19
4.6 Inspection/Acceptance of Supplies and Consumables 20
4.7 Non-Direct Measurements 20
5. Data Validation and Usability 21
5.1 Data Verification and Validation Methods 21
5.2 Data Quality and Usability 22
6. References 25

Tables

Table 1-1 Project Staff Contact Information

Table 2-1 Sampling Locations Within Each Sample Area

Table 2-2 Surface Sediment Sample Analytes

Table 2-3 Subsurface Sediment Sample Tiered Analytical Program for Areas 1 through 4

Table 3-1 Bulk Sediment Sample Analytes

Table 3-2 DRET Bulk Water Sample Analytes

Table 4-1 Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Surface Sediment Samples

Table 4-2 Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Subsurface Sediment Samples

Table 4-3 Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in DRET and Bulk Water Samples

Table 4-4 Sample Extraction Methods

Figures

Figure 1 Project Organization

Figure 2 Example Chain-of-Custody Form

Attachments (provided electronically only)

Attachment 1 Quality Systems Manual (QSM) for APEX Laboratories, LLC—includes list of SOPs, certification(s), and accreditation(s)

Attachment 2 Quality Assurance Plan (QAP) for Cape Fear Analytical LLC—includes list of SOPs, certification(s), and/or accreditation(s)

Attachment 3 Corporate Quality Manual for Bureau Veritas (formerly Maxxam) Laboratories—includes list of SOPs, certification(s), and accreditation(s)

Attachment 4 Corporate Quality Manual for Eurofins Calscience Laboratories—includes list of SOPs, certification(s), and accreditation(s)

Attachment 5 Quality Assurance Manual for ALS Environmental—includes list of SOPs, certification(s), and accreditation(s)

This page intentionally left blank.

Abbreviations and Acronyms

AOC	Administrative Settlement Agreement and Order on Consent
APEX	APEX Laboratories, LLC
BODR	Basis of Design Report, River Mile 11 East
Cargill	Cargill, Inc.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
City	City of Portland
CLP	Superfund Contract Laboratory Program
cm	Centimeter
COC	contaminant of concern
CQM	Corporate Quality Manual
DOC	depth of contamination
DOF	Dalton, Olmsted & Fuglevand, Inc.
DQMP	Data Quality Management Plan
DQI	data quality indicator
DQO	data quality objective
DRET	Dredge Elutriate Test
EDL	estimated detection limit
EPA	U.S. Environmental Protection Agency
FS	feasibility study
ft	foot or feet
Glacier	Glacier Northwest, Inc.
GSI	GSI Water Solutions, Inc.
HSP	Health and Safety Plan
J	estimated
LCS	laboratory control sample
LIMS	laboratory information management system

MDL	method detection limit
mm	millimeters
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NAVD 88	North American Vertical Datum of 1988
NELAP	National Environmental Laboratory Accreditation Program
PARCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCB	polychlorinated biphenyl
PCDD/Fs	polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
Portland Harbor	Portland Harbor Superfund Site
PTW	principal threat waste
QA	quality assurance
QA/QC Solutions	QA/QC Solutions, LLC
QA/QC	quality assurance/quality control
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality System Manual
R	rejected
RAL	remedial action level
RD	remedial design
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RL	reporting limit
RM	river mile
RM11E	River Mile 11 East
RM11E Group	Cargill, Inc.; CBS Corporation; City of Portland; DIL Trust; Glacier Northwest, Inc.; and PacifiCorp

ROD	record of decision
RPD	relative percent difference
RSD	relative standard deviation
SAP	sampling and analysis plan
Site	RM11E Project Area
SMA	sediment management area
SOP	standard operating procedure
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSS	total suspended solids
U	undetected
USACE	U.S. Army Corps of Engineers
Work Plan	Final Supplemental Remedial Investigation and Feasibility Study Work Plan

This page intentionally left blank.

1. Introduction

This Quality Assurance Project Plan (QAPP) was prepared by GSI Water Solutions, Inc. (GSI), on behalf of Cargill, Inc. (Cargill); CBS Corporation; City of Portland (City); DIL Trust; Glacier Northwest, Inc. (Glacier); and PacifiCorp, collectively referred to as the River Mile 11 East (RM11E) Group. The RM11E Project Area (Site) is shown in Figure 1-1 of the Phase I Remedial Design (RD) Sediment Sampling and Analysis Plan (SAP). The Site lies between approximately river mile (RM) 10.9 and RM 11.6 along the eastern bank of the Willamette River and includes the riverbank area to the top of the bank.

This QAPP, Appendix B of the SAP, describes the quality assurance/quality control (QA/QC) procedures that will be used to ensure the data collected under the SAP are of appropriate quality and will be useable to meet project objectives. This QAPP supplements the 2013 RM11E Final Supplemental RI/FS Work Plan (Work Plan) Appendix A QAPP Addendum (GSI and DOF, 2013), and follows similar procedures where possible and appropriate for consistency and comparability of the Phase I RD data with previous investigations. This work is conducted under the Administrative Settlement Agreement and Order on Consent (AOC) for Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work and Remedial Design, U.S. Environmental Protection Agency (EPA) Region 10, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. 10-2013-0087, Amendment No. 1.

1.1 Data Quality Objectives

The overall objective for the Phase I RD investigation is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. With the exceptions noted in this QAPP, the laboratory QA/QC procedures are consistent with those applied in the Work Plan (GSI and DOF, 2013).

To generate data that meet project objectives, it is necessary to identify the types of decisions that will be made and the intended uses of the data, then design a data collection program to meet those requirements. These steps are accomplished by applying the Data Quality Objective (DQO) process defined by EPA (EPA, 2006). The DQO process is a systematic planning tool designed to clarify the objectives of data collection and maximize efficiency during the data collection process. This process was used to help guide data collection designed to support the RD for this Phase I RD investigation. The results of the DQO process are a series of qualitative statements intended to clarify the objectives of the project, define the bounding parameters, and identify the error tolerance appropriate for the decisions being made with project information.

There are seven steps in the formal DQO process; the output of each step influences the choices of the next step. The DQO process is considered iterative and may be used repeatedly as the project progresses and the decisions change or require a different focus.

The seven DQO steps, along with general statements relative to the Site are as follows:

1. **State the Problem.** Additional information about sediment contamination is required to finalize the RD for the Site.[1] The sampling design was developed in close coordination with the design engineering team from Dalton, Olmsted & Fuglevand, Inc. (DOF), to collect the required information.
2. **Identify the Goals.** As described in Section 1.3 of the SAP, sampling activities are designed to meet the following goals:
   - Refine RM11E SMAs
   - Verify Area 6 Conceptual Site Model
   - Characterize the depth of contamination (DOC) of the Target Material
   - Develop dredge prisms for the Alternatives Evaluation and remedy design
3. **Identify the Information Inputs.** A significant amount of information used to address these questions has been collected in previous work and is summarized in Section 1.5 of the SAP. Supplemental sediment data will be collected during this Phase I RD Investigation to address the four primary goals listed under DQO Step 2. Specifically, to refine the SMAs and characterize the vertical extent of Target Material, 64 subsurface sediment core stations and 23 surface sediment stations are planned for sampling. Analytical protocols are described in Section 4 of this QAPP.
4. **Define the Boundaries of the Study.** This step is used to define geographic boundaries and other practical constraints, such as scale of evaluation and time frame. The Site is shown in Figure 1-1 of the SAP. The work conducted under the SAP and this QAPP includes evaluation of all SMAs that originate from within the RM11E Project Area boundary. The Phase I RD investigations at the Site are scheduled to be completed during 2020 to facilitate timely design of the remedy for the Site. The project schedule is discussed in Section 1.2 of this QAPP.
5. **Develop the Analytical Approach.** The analytical requirements for this design investigation are established to meet the three primary project objectives stated under DQO Step 2. To meet these variable objectives, samples will be analyzed for different analytes depending upon the medium and the specific objective to be met. Analytical detection limits were established to allow design decisions that consider the remediation thresholds (RTs) for the project. At RM11E, RTs are the lower remedial action level (RAL) value or principal threat waste (PTW) concentrations from the ROD Table 21 (Basis of Design Report, River Mile 11 East [BODR] Section 2.6; DOF and GSI, 2019). In the nearshore area, the RT is consistently the Portland Harbor site-wide RAL or PTW value established in the Portland Harbor Record of Decision (ROD) (EPA, 2017a). The analytical approach and the detailed analytical specifications for this investigation are presented in Section 2 and Section 4 of this QAPP.
6. **Specify Performance or Acceptance Criteria.** Uncertainty is present in all measurement data. This step establishes the performance criteria and degree of uncertainty that is acceptable to meet project objectives. These criteria include precision, accuracy, representativeness, comparability, and sensitivity. These criteria are addressed by applying QC requirements, which consist of the following:

[1] Riverbank soil sampling will be conducted in Phase II.

- **Field QC –** Proper sampling procedures described in the SAP, field split samples, equipment blanks, trip blanks, and temperature blanks.
- **Laboratory QC –** Laboratory QC procedures, method reporting limit (MRL)/reporting limit (RL) checks, method blanks, laboratory control samples (LCSs), matrix spikes (MSs), matrix spike duplicates (MSDs), laboratory blanks, surrogate spikes, calibration check samples, and laboratory replicates.

These QC and acceptance criteria are described in Sections 4 and 5 of this QAPP.

7. **Develop the Plan for Obtaining Data.** The plan for obtaining the data is the primary subject of the SAP and supporting documents (the Health and Safety Plan [HSP], this QAPP, and the Data Quality Management Plan [DQMP]). The basis of the sampling design, rationale for sampling tasks, and scope of the Phase I RD investigation are provided in the SAP.

1.2 Project Schedule

It is anticipated that this field investigation will begin during the second quarter of 2020 and require approximately two to three months to complete. The sampling event is targeted for the period of high water that typically occurs in May and June to provide access for sampling vessels behind docks and in remnant piling fields. The actual field schedule is contingent upon receiving final approval of the SAP and may vary based on subcontractor availability, adverse weather, river levels, access to sampling locations, equipment conditions, and unforeseen factors.

Laboratory data will be due 30 days from receipt of the last sample in each sample batch. Final validated analytical laboratory data will be provided 30 days from the last date of receipt from the laboratories. A draft Phase I RD Field Sampling and Data Report will be prepared and is anticipated for submittal to EPA within 90 days of receiving the final validated analytical laboratory data. The RM11E Group will keep EPA updated on the progress of this investigation and apprised of unanticipated conditions, should they arise.

1.3 Project Organization

The sample collection program described in the SAP will be conducted by a team of scientists and engineers from GSI and DOF with the requisite experience and technical skills and will be supported by sample collection contractors with the expertise and equipment needed to meet the required sampling.

The analytical program described in this QAPP will be led by APEX Laboratories, LLC (APEX) and supported by specialty laboratories for selected analytical groups. The work will also require the services of a third-party data validation specialist.

The project organization and roles and responsibilities are described in Section 2 of the SAP and the project organization chart is summarized in Figure 1. Key project staff and their contact information are listed in Table 1-1. Members of the project team are expected to communicate on a routine basis to ensure the data produced from this Phase I RD sampling program meet project objectives for RD. The Field Investigation Project Manager will maintain the official, approved QAPP.

1.4 Special Training/Certification

The Superfund Amendments and Reauthorization Act of 1986 required the U.S. Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. The Code of Federal Regulations (CFR) 29 1910.120 requires that employees receive training in the skills enabling them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the Occupational Safety and Health Administration (OSHA) regulations. Additional information regarding health and safety is provided in the HSP in Appendix A in the SAP.

It is important that field staff are trained in standardized sediment sampling procedures and requirements, so that data collected are consistent among field staff. All field staff are fully trained in the collection and processing of sediment samples, decontamination protocols, visual inspections, and chain-of-custody procedures.

The minimum training and certification requirements for laboratory personnel are described in the applicable laboratory quality systems manual (QSM), quality assurance plan (QAP), corporate quality manual (CQM), and quality assurance manual (QAM) in Attachments 1 through 5 of this QAPP (available electronically only).

1.5 Documents and Records

Field sampling staff will maintain records that document all activities and data related to sample collection and laboratory analyses. Results of data verification and validation activities will also be documented. Procedures for documentation of these activities are described in this section. The SAP will be provided to every project participant listed in the distribution list. Any revisions or amendments to any of these documents will also be provided to these individuals.

1.5.1 Field Documentation

The following field records will be maintained throughout the duration of sampling activities:

- Field logbooks
- Field data forms
- Sample description forms
- Sediment core logs
- Sample labels
- Sample chain-of-custody forms
- Custody labels
- Photographic documentation

Field documentation related to sample collection will be maintained in the project file in GSI's office in Portland, Oregon. The laboratories will return original completed chain-of-custody forms to GSI and these will also be maintained in the project file.

The following reports will be completed, as necessary, to document an audit or a deviation from the SAP or this QAPP:

- Corrective action reports will be used, as necessary, to document any problems encountered during field activities and corrective actions will be taken.
- Field change request forms will be used, as necessary, to document the need for a procedural or a station location change.
- System and performance audit reports will be used, as necessary, to document a review or audit of field sampling activities.

The Field Investigation Project Manager and Sampling and Analysis Coordinator will ensure that the field team receives the final approved version of the SAP and this QAPP prior to the initiation of field activities.

1.5.2 Laboratory Documentation

All activities and results related to sample analysis will be documented at each laboratory. Internal laboratory documentation procedures are described in the applicable laboratory QSM, QAP, CQM, and/or QAM in Attachments 1 through 5 of this QAPP (available electronically).

Each laboratory will provide a data package that is comparable in content to a full Superfund Contract Laboratory Program (CLP) package for each sample delivery group or analysis batch. The format of the data may differ from CLP requirements. Each data package will contain all information required for a complete QA review, including the following, as it may be applicable to the analysis completed:

- A cover letter discussing analytical procedures and any difficulties that were encountered
- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from standard operational procedures (SOPs) and this QAPP
- Chain-of-custody and cooler receipt forms
- A summary of analyte concentrations (to three significant figures, unless otherwise justified), method detection limits (MDLs), estimated detection limits (EDLs), MRLs/RLs,
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Sample preparation and cleanup logs
- Instrument tuning check data
- Initial and continuing calibration data, including instrument printouts and quantification summaries, for all analytes

- Results for method and calibration blanks
- Results for all method-specific QA/QC checks, including but not limited to surrogate spikes, labeled compounds, internal standards, LCSs, MSs, MSDs, and laboratory duplicate or triplicate samples provided on summary forms
- Instrument data quantification reports for all analyses and samples
- Florisil check data, gel permeation chromatography, or other sample extract cleanup calibration data (if completed)
- Copies of all laboratory worksheets and standards preparation logs

Data will be delivered in electronic format to the Analytical Chemistry QA Manager, who will be responsible for oversight of data verification and validation and for archiving the final data and data quality reports in the project file. GSI will maintain data packages and electronic data deliverables for chemical analyses.

Electronic data deliverables will be compatible with GSI's Enviro Data SQL Server database.

Laboratory data will be maintained by each laboratory for a period of at least 5 years. These data will include the original instrument electronic data files, reduced and verified data stored in the laboratory information management system (LIMS,) and final PDF report and electronic data deliverables. The laboratories will obtain approval from the RM11E Group prior to discarding these data.

1.5.3 Data Quality Documentation

Data validation reports will be prepared by the contracted validation firm; the Analytical Chemistry QA Manager will be responsible for maintaining all data validation reports. Results of the validation reports will be summarized in the applicable draft Phase I RD Field Sampling and Data Report. Any limitations to the usability of the data will also be discussed in this report.

All electronic database entries provided by each laboratory will be verified against the validated hard-copy data in the data package. All changes to the database will be documented in an electronic log file that automatically enters a current time stamp when opened and allows the data editor to enter notes about changes to the database. Any data tables prepared from the database for data users will include all qualifiers that were applied by the laboratories and used during data validation, unless otherwise requested.

2. Data Generation and Acquisition

This QAPP, in conjunction with the project-specific SAP, will guide sampling, analysis, data assessment, and other monitoring-related activities conducted for this project and ensure that QC and consistency are maintained. This section describes the overall sampling design intended to serve as a reference to project team members responsible for the quality assurance of the field and laboratory work.

2.1 Sampling Process Design and Methodology

The Phase I RD Investigation consists of collection of surface and subsurface sediments throughout the Site. For the purposes of facilitating sample design and implementation, the Phase I RD sampling was organized into six in-water sample areas. Sample location maps showing the sample areas and the rationale (see Table 3-2 in the SAP) for sample locations in each area are presented in the accompanying SAP (see SAP Figure 3-1). As reference for laboratory staff, Table 2-1 of this QAPP identifies the sampling locations in each sample area. A summary of the sampling design and analytical requirements for each medium and sample area is presented below. Detailed analytical requirements for this Phase I RD sampling are presented in Sections 3 and 4 (and associated tables) of this QAPP.

2.1.1 Surface Sediments – Areas 1 through 5

As shown in Figure 3-2 of the SAP and in Table 2-1 of this QAPP, 23 stations are identified for collection of surface sediment samples. These will be three-point composited grab samples with a target penetration depth of 30 centimeters (cm) below the mudline and a minimum acceptable penetration depth of 20 cm. It is important to note that analytical requirements for surface sediments that are presented in Table 2-2 vary in different sample areas.

2.1.2 Subsurface Sediments Tiered Analytical Program – Areas 1, 2, 3, and 4

A total of 59 stations are identified on Figure 3-5 of the SAP and in Table 2-3 for collection of subsurface sediment cores in Areas 1, 2, 3, and 4. At each subsurface station, the target core depth is up to 10 to 25 ft below the mudline, or until refusal occurs due to encountering the native alluvial gravel and/or Troutdale Formation gravel deposits. The depth may be adjusted based on conditions encountered in the field. All core samples will be logged in the core processing facility, sectioned into 1-ft intervals, and sent to the laboratory for tiered analysis and archival.

The tiered laboratory analytical program is described in detail in the SAP and summarized in Table 2-3 and on Figure 5-1 of the SAP. This will be an iterative process for each core; it is critical that GSI field staff and APEX laboratory staff work closely to ensure that the correct depths are achieved and the correct analyses are conducted. It is anticipated that, during the coring program, routine calls between the GSI teams and the laboratory will be required.

2.1.3 Subsurface Sediments – Area 6

As shown on Figure 3-5 of the SAP, the five (5) sample stations proposed in Area 6 will be sampled using sonic coring techniques. At each station, the target core depth is up to 5 ft below

the mudline. The 5-ft cores will be sectioned into 1-ft intervals. The upper 1- and 2-ft intervals at each core location will be submitted to the laboratory for processing and analysis. The remaining intervals will be archived.

A modified approach was developed for Area 6 to allow calculation of the bulk sediment concentrations based on grain size distribution and chemical analysis of the fine-grained fraction. This approach is described in detail in Section 4.3.2 and will provide representative concentration information that will be useful in determining the remedial approach for this downriver area during RD.

2.2 Field QC Samples

Field QC samples are used to evaluate the effectiveness of sample homogenization and within-sample variability (e.g., splits), evaluate potential sources of sample cross-contamination (e.g., rinsate blanks), or confirm proper shipping/storage conditions (e.g., temperature blanks). Procedures for field QC samples are described in Table 5-5 of the SAP.

The types and frequency of QC samples that will be collected during the sampling event are described below.

2.2.1 Split Samples

Field split samples are multiple samples taken from a single location after the media have been homogenized. Field split samples will be collected at a frequency of 5 percent or a minimum of one sample per medium (whichever is greater). For the subsurface core intervals, the field splits will be identified by the field team based on the number of samples submitted to the laboratory for analysis in accordance with the tiered analytical approach (see Section 2.1.2). The origin of the split is blinded to the laboratory to provide information on the variability associated with sample preparation/handling and laboratory analysis. Split samples will be submitted to the contract laboratory for analysis of the same analytical suite as their corresponding "parent" sample.

2.2.2 Rinsate Blanks

The introduction of chemical contaminants during sampling and analytical activities will be assessed by the analysis of rinsate blanks. Rinsate blanks, consisting of sampling equipment rinsate, will be generated at frequency of 5 percent per sampling method (see Table 5-5 of the SAP) and submitted for analysis to the primary contract laboratory. The three rinsate blanks will be analyzed for PCB Aroclors and PCDD/Fs.

PCBs are the primary risk driver at the Site. Historically, any contaminant of concern (COC) reported as detected in an equipment rinsate once normalized to solid unit basis has not resulted in qualification of associated sample results. Further any detections in a rinsate blank are only applicable to the one sample collected prior to the time of collection of the rinsate blank and, therefore, not pertinent to all sample collection activities.

2.2.3 Trip Blanks

Trip blanks are used to monitor for cross contamination of volatile constituents during sample processing and transportation. Trip blanks are not required for this sediment investigation.

2.2.4 Temperature Blanks

Temperature blanks are used to measure and ensure the temperature of the cooler upon receipt of samples at the primary contract laboratory. One temperature blank will be prepared and submitted with each cooler shipped to the laboratory. The temperature blank will consist of a sample jar containing deionized water that will be packed into the cooler in the same manner as the rest of the samples and labeled "Temp Blank."

2.3 Sample Handling, Custody, and Transport

Detailed descriptions of the procedures for sample identification, handling, documentation, custody, and ultimate disposal are documented in Section 4 of the SAP. These procedures will be followed to ensure that samples collected during this investigation are traceable. As stated in the project-specific SAP, the Field Investigation Project Manager and Sampling and Analysis Coordinator will be responsible for sample tracking in the field and will relinquish the sealed and packaged samples to the designated analytical laboratory courier service or commercial transport company (e.g., FedEx).

The Laboratory Project Manager will be responsible for upholding intra-laboratory and sub-laboratory sample transfer and tracking records through all stages of laboratory processing.

Specifications for sample containers, preservation, and holding times are presented in Table 4-2 of the SAP.

Chain-of-custody and shipping procedures are outlined in the RM11E Focused Sediment Characterization SAP and will follow the protocols outlined therein (GSI, 2009). Chain-of-custody forms will be completed before samples are transported to the laboratory. Laboratory chain-of-custody procedures are specific to each laboratory and provided electronically as attachments to the QAPP.

All samples received will be sent with a chain-of-custody document. A written chain-of custody procedure is available for use upon request. The purpose of this procedure is to maintain an accurate written record that can be used to trace the possession of the sample from the moment of collection through final analysis. In addition, this procedure ensures that the samples are handled only by authorized and properly trained personnel. An example chain-of-custody form is provided as Figure 2.

2.4 Corrective Actions

A formal chain of communication has been established for this project to optimize the flow of information and to keep the management team apprised of activities and events. The field team will stay in close verbal contact with the Sampling and Analysis Coordinator, Field Investigation Project Manager, and Analytical Chemistry QA Manager during all phases of the project. These individuals will, in turn, keep the project managers informed of any significant developments in the field or at the laboratories.

The Field Investigation Project Manager may conduct field performance audits at least once during sampling, which may identify the need for corrective actions, if necessary. The Field Investigation Project Manager will immediately institute the necessary corrective actions,

complete a corrective action form, and conduct an additional audit to ensure that the correct procedures continue to be followed.

If corrective actions require a departure from the SAP, these changes will be documented on a field change request form (see SAP Attachment 3). In any other circumstances in which sampling conditions are unexpected, the appropriate sampling actions consistent with project objectives will be conducted. This change will be noted in the field log, and a change request form will be completed for the project files.

3. Bulk Sediment Testing

Bulk sediment samples are required for disposal characterization, elutriate testing, and bench testing for sediment treatability and handling properties. Specific objectives of the bulk sediment sampling are the following:

- **Disposal Characterization.** Samples of bulk sediment will be tested as specified by the Resource Conservation and Recovery Act (RCRA) by the toxicity characteristic leaching procedure (TCLP) for site-specific metals (chromium and lead) to characterize dredged sediments for disposal characteristics.
- **Dredging Elutriate Testing.** Elutriate water samples from bulk sediment will be analyzed by the Dredging Elutriate Test (DRET) to evaluate the potential for short-term releases during dredging operations.
- **Treatability Testing.** Site water mixed with bulk sediments will be dosed with various coagulants and flocculants to identify effective agents and dose rates to clarify the dredge return water.
- **Dewatering and Stabilization.** Samples of bulk sediments will be mixed with two different amendments (Portland cement and ZapZorb) to identify effective agents and dose rates to dewater and/or stabilize dredge material as needed for transportation and/or disposal of dredged material.

The bulk sediment collection program is described in Section 4.8 of the SAP. The analytical requirements for the bulk sediment testing are presented in Table 3-1. This bench testing of bulk sediment will be performed by DOF staff at the DOF geotechnical laboratory in Portland, Oregon. The DRET will be performed by ALS Laboratories. The following sections describe the tests and methodologies to meet the bulk sediment testing objectives.

3.1 TCLP Testing for Disposal Characterization

Three bulk samples (see SAP Section 4.8) will be tested using TCLP for lead and chromium to confirm that the sediments meet the requirements to be managed as nonhazardous waste. In the BODR Section 6.2.7 (DOF and GSI, 2019), analytical data from site sediment samples are compared with Table 1 of 40 CFR 261.24 and screened for TCLP characteristics using the TCLP rule of 20 times for total concentrations.[2] Out of 180 low-level total metals detections, only two chromium samples (RM11E-G026 and RM11E-SL022) and 19 lead samples had total concentrations above 100 parts per million, which exceeds the TCLP rule of 20 times.

[2] The TCLP rule of 20 times allows for total concentration analysis to be used in lieu of the TCLP extraction procedure by multiplying the regulatory limit by 20 (or dividing the total constituent analysis by 20) to compare. The method is derived from the 20:1 liquid-to-solid ratio used in the TCLP procedure.

3.2 DRET Testing

DRET will be completed on three bulk samples per the procedures described in Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities — Testing Manual (U. S. Army Corps of Engineers [USACE], 2003). Based on comparison of RM11E data to the trigger screening levels in the Sediment Evaluation Framework for the Pacific Northwest (RSET, 2018), the elutriate (DRET bulk water samples) will be tested for Surface Water COCs listed under the ROD Table 17 analytes (Table 3-2).

3.3 Treatability Testing

Dredge water testing will be completed in two steps: (1) jar testing to estimate a potential range of total suspended solids associated with dredge water and (2) water clarification testing.

3.3.1 Jar Testing

1. Prepare four sets of three 1-liter (L) wide-mouth clear glass jars (12 jars total) with one part bulk sediments and four parts site water by volume.
2. Cover jar; shake for 3 to 5 minutes. Place jar on table and wait for the designated times listed below which simulate a range of potential settling times in a treatment facility. Following completion of each settling period, the water will be decanted into laboratory-supplied jars for testing. Collect three replicates per settling time.
3. Settling times:
   - 1 minute – Simulates the most limited settling time and represents the most conservative and difficult water to treat.
   - 1 hour and 4 hours – The consecutive settling times were chosen using best professional judgment, given typical flow rates and settling times from multiple past projects that DOF has performed.
   - 8 hours – Simulates a conservative, yet reasonable settling time for water treatment.
4. Test the water from each of the replicates for each holding time for the following (Table 3-1 and SAP Table 4-2):
   - Total suspended solids (TSS)
   - Total dissolved solids (TDS)
   - Total organic carbon (TOC)
   - Cations
   - Anions
   - Hardness
   - pH
5. Tabulate and report results.

3.3.2 Water Clarification Testing

The purpose of the water clarification testing is for the vendors to determine the effective dose rates for clarifying dredge return water. This will be accomplished in two steps:

1. Provide water treatment vendors with the results of the jar testing and samples of bulk sediment and site water to use in performing clarification testing. Vendors will test the water at the range of TSS observed in the jar testing.
2. Water treatment vendors will recommend dose rates and agents to clarify dredge water at the high, low, and mid-range of observed TSS from the jar tests. Vendors will report the associated expected turbidity, TSS, and TDS in the clarified water at each level.

3.4 Bench Tests for Stabilization and Handling

Bench tests for stabilization and handling are intended to provide an indication of how the sediments will react to handling, stacking, drying, and amending, among other characteristics that can be observed and recorded. The handling and stabilization requirements for the potential dredged sediments will be evaluated by physical manipulation of saturated sediments as well as the addition of various amendments. Applying various drying reagents as well as other absorption amendments at varying quantities will provide an estimate of the effort and admixtures that may be needed for landfill transportation and disposal. Various amendments will be evaluated as part of a bench test and the results will be observed and recorded. The procedure is as follows:

1. Bulk sediments that were collected and placed in labeled 5-gallon buckets with sealed lids will be used in the bench test.
2. A general description of the observed range of grain sizes within each sample (e.g., sand with silt, mostly silt) will be recorded.
3. Subsamples will be taken from each sample and placed into a bowl of known mass and weighed.
4. Water will be added to three subsamples, the first at 10 percent by mass, the second at 15 percent to 20 percent, and the third at 20 percent to 30 percent, depending on the nature of the sediments. Each subsample will be stirred with a paint stick to incorporate all added water into the sediments.
   - **Control Samples.** Each sediment and water mixture will be allowed to sit for increasing time increments including 1 hour; and up to 4 hours, 8 hours, and 24 hours; and then subjected to paint filter testing, slump testing, and admixture testing (see below).
   - **Paint Filter Testing.** Each sediment and water mixture will be subject to paint filter testing for landfill disposal per EPA SW-846 Test Method 9095B that prescribes that a predetermined amount of material is placed in a paint filter. The detailed steps of the paint filter test are as follows:
     1. Sediments will be placed in a standard, conical paint filter in fine-mesh size (mesh number 60 +/- 5 percent).
     2. Sample will be allowed to drain for 5 minutes into a graduated cylinder.

3. If any portion of the test material collects in the graduated cylinder in the 5-minute period, the material is deemed to contain free liquids.

- **Slump Testing.** Slump testing will be conducted as follows:

  1. Use a mini-slump cone (6 inches [in] tall, 2 in top diameter, and 4 in bottom diameter) for the slump test.
  2. Use approximately 1 L sediments per test.
  3. Fill the cone in three layers, with each layer tamped 25 times with a 3/8-in steel rod.
  4. When the mold is completely full, level the top surface with the rim of the cone.
  5. Immediately after leveling, carefully remove the cone vertically, allowing the unsupported material to slump.
  6. Measure the slump by placing the cone beside the slumped material, placing the tamping rod across the top of the cone so that it extends over the slumped material. Measure the distance from the tamping rod to the top of the slumped material and record the measurement as slump in inches.

- **Admixture Testing**. Admixture testing will be conducted as follows:

  1. Water will be added to three subsamples, the first at 10 percent by mass, the second at 15 percent to 20 percent, and the third at 20 percent to 30 percent, depending on the nature of the sediments. Each subsample will be stirred with a paint stick to incorporate all added water into the sediments.
  2. Each subsample with added water will be held for 1 hour prior to initiating admixture testing. Measure and record water content at the end of the holding time, prior to initiating the admixture testing.
  3. Admixtures—including Portland cement and ZapZorb (a superabsorbent polymer solidification product)—will be added to subsamples in increasing doses by mass. Portland cement will be added in 5 percent increments; ZapZorb will be added in 0.2 percent increments. The subsamples will be mixed and allowed to set up for increasing time increments (1 hour; and up to 4 hours, 8 hours, and 24 hours) as needed to pass the paint filter test.
  4. Complete and record a paint filter test at each dose rate and time increment until a passing result is achieved, and measure and record the water content of the sample passing the paint filter test.

4. Laboratory Analysis and QA/QC

This section summarizes the physical and chemical analyses to be performed on samples collected during the Phase I RD sampling, and the laboratory QC protocols that will be followed to ensure that data quality and representation are in accordance with method requirements. These procedures conform to the laboratories' quality manuals (i.e., QSM, QAP, CQM, and/or QAM) provided in Attachments 1 through 5 to this QAPP (available electronically only). The procedures include EPA, ASTM International, and other regulatory-accepted methods and protocols.

Each laboratory is using EPA-approved methods and/or methods approved from previous investigations conducted at the Portland Harbor Superfund Site. All labs are certified and accredited (see Attachments 1 through 5), therefore, copies of SOPs are not included in the QAPP. SOPs may be reviewed on a case-by-case basis. EPA review can be facilitated and discussed with the laboratory.

Specifications regarding the analyte suites and analytical quantification limits for bulk sediment and water samples and each of the two media (surface and subsurface sediments) are provided in Tables 3-1, 3-2, 4-1, 4-2, and 4-3. The supporting sample extraction methods are presented in Table 4-4. A tiered laboratory analytical program will be implemented at each core location to determine the depth of the target material. This tiered approach is discussed in Section 2.1 of this QAPP and Section 5.2 of the SAP.

4.1 Data Quality Indicators

The overall quality objective for this investigation is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCS)—data quality indicators (DQIs) that are commonly used to assess the quality of environmental data. Tables 4-1, 4-2, and 4-3 list specific DQIs for the laboratory analyses of all samples, including the target MDL, EDL, and MRL/RL.

4.1.1 Precision

Precision is the measure of the reproducibility among individual measurements of the same property, usually under conditions that are similar. Precision is assessed by performing multiple analyses on a sample. Precision is expressed as a relative percent difference (RPD) when duplicate analyses are performed and as percentage of relative standard deviation (% RSD) when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed through laboratory duplicate analyses (i.e., laboratory replicate samples, MS/MSD, LCS duplicates) for all parameters except when reference materials are not available, or spiking of the matrix is inappropriate. In these cases, precision is assessed through laboratory triplicate analyses. Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as either % RSD or RPD) increases. The DQI for precision varies depending on the analyte (Tables 4-1, 4-2, and 4-3). The equation used to express precision is as follows:

$$\text{RPD} = \frac{(A - B)}{A + B/2} \text{ X } 100$$

Where:

A = Analytical result from one of two duplicate measurements

B = Analytical result from the second measurement

Precision measurements can be affected by how close a chemical concentration is to the reporting limit, which can increase the percent error (expressed as RPD).

4.1.2 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 recovery for MS, LCS, and ongoing precision and accuracy sample analyses. The DQI for accuracy varies, depending on the analyte. The equation used to express accuracy for spiked samples is as follows:

$$\text{Percent Recovery} = \frac{Spike\ sample\ result - unspiked\ sample\ result}{Amount\ spike\ added} \text{ X } 100$$

4.1.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. The sampling approach was designed to address the specific project objectives discussed in Section 1. Assuming those objectives are met, the samples collected should be considered adequately representative of the environmental conditions they are intended to characterize.

4.1.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. Sample collection and chemical and physical testing will adhere to the most recent EPA protocols.

4.1.5 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:

$$\text{Completeness (percent)} = \frac{Number\ of\ acceptable\ data\ points}{Total\ number\ of\ data\ points\ collected} \text{ X } 100$$

The DQO for completeness for all components of this project is 95 percent. Data that have been qualified as estimated (because the quality check [QC] criteria were not met) will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

4.1.6 Sensitivity

Analytical sensitivity is a measure of both the ability of the analytical method to detect the analyte and the concentration that can be reliably quantified. The minimum concentration of the analyte that can be detected is the MDL or EDL (for polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans [PCDD/F] analyses). The minimum concentration that can be reliably quantified is the MRL. Laboratories use MDLs, EDLs, and MRLs for reporting analyte concentrations; these values will be used as measures of sensitivity for each analysis.

The MDL is defined as the lowest concentration of an analyte or compound that a method can detect in either a sample or a blank with 99 percent confidence. MDLs are determined using standard procedures outlined in 40 CFR 136, in which seven or more replicate samples are fortified at 1 to 5 times (but not to exceed 10 times) the expected MDL concentration. The MDL is then determined by calculating the standard deviation of the replicates and multiplying by the Student's t-factor (e.g., 3.14 for seven replicates). EDLs are specific to the analysis of PCDD/Fs and are calculated using the procedure described in EPA Method 1613, Revision B.

MRLs are equal to or greater than the lower calibration limit defined by the lowest concentration on the calibration curve. MRL/RL and EDLs are adjusted for each sample based on the amount of sample extracted, dilution factors, and percent moisture (solid samples). All laboratories will report detected concentrations above the MRL/RL (as may be applicable) without qualification and report detected concentrations between the MDL or EDL (PCDD/Fs data only) and the MRL/RL with a J-qualifier indicating the concentration is an estimated value. The EDL calculated for the analysis of PCDD/Fs is a sample-specific detection limit based on the signal-to-noise ratio of 2.5 at the time of sampling. Non-detect results will be reported to the MRL/RL or EDL with a U-qualifier. The applicable target MDLs, EDLs, and MRLs/RLs are listed in Tables 4-1, 4-2, and 4-3.

4.2 Laboratory QA/QC Procedures

Laboratory QA/QC will be maintained through the use of standard EPA and other accepted methods and standard analytical procedures for the target analytes. These procedures are incorporated the collection and analysis of the following laboratory QA/QC components:

- Internal QC samples
- MRL checks
- Method blanks
- MS and MSD samples
- Laboratory blank spikes
- Surrogate spikes
- Calibration check samples
- Laboratory replicates
- PCDD/Fs-specific components (e.g., Initial Precision and Recovery, isomer-specificity standards, labeled compound and cleanup standard recoveries, ion abundance ratios, Estimated Maximum Possible Concentrations) as specified in EPA Method 1613, Revision B.

Performance-based control limits established by the laboratory and control limits provided in the method protocols will be used to evaluate data quality and determine the need for data qualification. Laboratory control limits for surrogate compounds, LCSs and LCS duplicates, and MS/MSDs are provided in Tables 4-1, 4-2, and 4-3 and will be used for data validation.

The method-specific and other analytical and laboratory QC procedures and protocols followed are detailed in the laboratory quality manuals attached to this QAPP (Attachments 1 through 5).

4.3 Sample Preparation Protocols

4.3.1 Standard Laboratory Preparation Method for Chemical Analysis

The following steps describe the protocols that will be followed for the majority of the RM11E sediment samples. The exception is the preparation of sediment samples collected in Area 6, which is described in the following section.

1. Coolers containing samples are received from field team and individual samples are logged into the laboratory information management system (LIMS) to track analytical requirements, holding times, and results.
2. The analyst decants and disposes of any standing liquid from 8-ounce glass sample containers.
3. The remaining sample is emptied into a stainless steel mixing bowl.
4. The contents of the bowl are manually stirred with a stainless steel spatula to mix the contents.
5. A subsample of the bowl is removed with a spatula to create the required sample mass to be analyzed (e.g., 15 grams of material is required for EPA Method 8082).

4.3.2 Area 6 – Air Dry, Sieve, Analysis of Finer-Grained Fraction

The sample preparation in Area 6 has been modified to include air drying, grain size determination, and analysis of the finer-grained fraction of sediments. This approach was selected for Area 6 because of the predominance of coarse-grained materials (cobbles and gravels) in the sediments in this area. It is assumed that these coarse, silica-rich geologic materials, contain a minor fraction of the contaminants found in the sediment mass, and that most of the contamination will be on the more carbon- and clay-rich fine particles.

Samples will be provided to the laboratory for processing and archiving using the following protocols:

- Cores will be sectioned into 1-ft intervals. The upper 1- and 2-ft intervals at each core location will be submitted to the laboratory for processing and analysis. The remaining intervals will be archived.
- Samples targeted for analysis in Area 6 will be air dried and sieved prior to analysis. The total mass of the sample and mass of each grain size fraction retained on the sieve screens will be recorded.
- The fine-grained fraction of sample (grain size < 2 millimeters [mm]) will be analyzed for PCB Aroclors, TOC, total solids, and grain size. The laboratory will prepare representative

samples for analyses consistent with Interstate Technology & Regulatory Council guidelines (ITRC, 2020) and Apex SOP-G 105 RSM. Comminution of < 2 mm fraction to less than 60-micron particles will be completed prior to analyses of PCB Aroclors, TOC, and total solids. The processing is necessary to create a representative mixture of particles, all of equal size and shape.

- The results of the fine fraction analysis will be reported in accordance with requirements set forth in Table 4-2.
- The results from the grain size analysis of the bulk sample will be used to calculate the percentage of the total sample mass made up of the analyzed fine-grained fraction of the sample (< 2 mm).
- By obtaining the mass of bulk sediments, the mass of the finer-grained fraction that was analyzed, and the total PCB concentration of the fine fraction, an estimation of the total PCB concentration of the bulk sediment sample will be made. The estimate is made by multiplying the analytical result of the fine fraction times the percentage of the fine material that makes up the total sample mass.

4.4 Instrument and Equipment Testing, Inspection, and Maintenance

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted by each laboratory in accordance with the requirements identified in the laboratory QA manuals, analytical laboratory SOPs, and manufacturer instructions. Laboratory facilities are designed to meet specific operating conditions and maintained in a condition to ensure that acceptable operating conditions are met. Instruments will only be utilized for sample analysis if they demonstrate the capability of achieving the required accuracy and compliance with relevant instrument specifications. Only authorized personnel will operate analytical instrumentation and testing equipment. Instrument maintenance and repair will be documented in maintenance logs or record books.

4.5 Instrument/Equipment Calibration and Frequency

All applicable laboratory instruments used will be properly calibrated and the calibration will be verified with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument calibration procedures and schedules will conform to analytical protocol requirements and descriptions provided in the laboratories' QA manuals and applicable SOPs.

Calibration standards will be obtained from either the EPA repository or a commercial vendor, and the laboratory will maintain traceability to the National Institute of Standards and Technology. Stock standards will be used to make intermediate standards and calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and prevention of contamination. Documentation relating to the receipt, mixing, and use of standards will be recorded in a laboratory logbook. All calibration and spiking standards will be checked against standards from another source.

Field instruments will not be used in connection with sediment sampling.

4.6 Inspection/Acceptance of Supplies and Consumables

The quality of supplies and consumables used during sample collection and laboratory analyses can affect the quality of the project data. All equipment that comes into contact with the samples and extracts must be sufficiently clean to prevent detectable contamination, and the analyte concentrations must be accurate in all standards used for calibration and QC purposes.

During sample collection, solvents of appropriate and documented purity will be used for decontamination. Solvent containers will be dated and initialed when they are opened. The quality of laboratory water used for decontamination will be documented at the laboratory that provides that water. Cleaned and documented sample containers will be provided by the laboratories. All containers will be visually inspected prior to use, and any suspect containers will not be used and will be discarded.

Reagents of appropriate purity and suitably cleaned laboratory equipment will also be used for all stages of laboratory analyses. Details for acceptance requirements for supplies and consumables at the laboratories are provided in the laboratory SOPs and QA manuals (Attachments 1 through 5). All supplies will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be retained by GSI (i.e., for supplies used in the field) or the laboratories.

4.7 Non-Direct Measurements

Existing chemical data from previous investigations will be used for this investigation. All historical data have been reviewed for quality assurance. Non-direct measurements will not be needed for the completion of this sampling investigation.

5. Data Validation and Usability

All data generated in the field and at the laboratories will be verified and validated according to methods and protocols outlined in this section. Data quality and usability will be evaluated, and a discussion will be included in a Data Validation Review Memorandum that will be an attachment to the Field Sampling and Data Report.

5.1 Data Verification and Validation Methods

Validation and reporting of data quality will follow method-specific and laboratory-established QC requirements, as applicable, and the guidelines that may be applicable to the analytical methods used in the following documents:

- Method-specific and laboratory-established QC requirements, as applicable
- Guidance on Environmental Data Verification and Validation (EPA, 2002)
- Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. OSWER No. 9200.1-85. EPA 540-R-08-005 (EPA, 2009)
- National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA, 2016)
- National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA, 2017b)
- National Functional Guidelines for Organic Superfund Methods Data Review (EPA, 2017c)

The Chemistry QA Manager will coordinate with the contract laboratories during sample analysis and delivery of analytical results. The Chemistry QA Manager will perform an abbreviated data validation review (Stage 2B) (EPA, 2009) on 90 percent of all results reported for all analyses completed. Ten percent of all results reported for all analyses completed will undergo a comprehensive (100 percent) review (Stage 4) (EPA, 2009) of the applicable QC measurement data to document the performance of the laboratory analyses and to determine the usability of the data toward meeting project objectives. For the abbreviated data validation review of all data reported for all analyses completed, the following laboratory deliverables (if present) will be reviewed:

- Case narratives discussing analytical problems (if any) and procedures.
- Chain-of-custody documentation to verify completeness of the data set.
- Laboratory summary result forms to verify that analytical holding times were met.
- Results for applicable method blanks, trip blanks, and equipment rinsate blanks will be evaluated to determine whether an analyte reported as detected in any sample was the result of possible contamination introduced at the laboratory or during field sampling.
- Results for applicable surrogate compound, LCS (i.e., blank spike), duplicate LCS, MS, and MSD recoveries to assess analytical accuracy.

- Results for applicable laboratory duplicate sample, duplicate LCS, and MSD analyses to assess analytical precision.
- Results for all other method-specific QC measurements.
- Review of laboratory summaries of analytical results.
- Results for the field split sample(s) to provide additional information.

To complete the 100 percent data validation review on 10 percent of all data reported for all analyses completed, the following items will be reviewed in addition to the items listed above:

- Results for applicable instrument tuning, initial calibrations, and continuing calibration (verification) results to assess instrument performance.
- Results for applicable internal performance to ensure that instrument sensitivity and response were stable during the analysis of the samples.
- Results for applicable method-specific QC measurements (e.g., dual-column confirmation results for the PCB analyses) to assess potential matrix interference effects.
- Results for applicable QC measurements required for the analysis of PCDD/Fs.
- A review of instrument printouts (e.g., chromatograms, mass spectra, and quantification reports) to assess the validity of analyte identification as either detected or undetected
- Verifying quantification of sample results and applicable QC measurement (e.g., instrument calibrations; surrogate, MS/MSD, and LCS recoveries; and other applicable information for accuracy and precision) results by recalculation.

If significant systemic QC problems are discovered using this approach, the Chemistry QA Manager will consult with the Laboratory Project Manager and the Field Investigation Project Manager to determine whether full data validation is warranted for additional samples. To accommodate the potential for additional data validation, the laboratory will provide a full electronic data package for all samples.

5.2 Data Quality and Usability

The overall quality objective for this RD investigation is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The laboratory QA/QC procedures listed in Section 4 document the precision and accuracy of the measurements and provide a basis from which to assess the representativeness, completeness, comparability, and overall quality of the environmental data.

Performance-based control limits established by the laboratory and control limits provided in the method protocols will be used to evaluate data quality and determine the need for data qualification. Laboratory control limits for surrogate compounds, LCSs and LCS duplicates, and MS/MSDs are provided in Tables 4-1, 4-2, and 4-3 and will be used for data validation.

No guidelines are available for validation of data for analysis of such constituents as conventional analyses (e.g., total organic carbon), physical testing (e.g. grain size), and petroleum hydrocarbons (e.g., diesel and/or oil hydrocarbons); therefore, applicable data validation requirements specified in National Functional Guidelines (EPA, 2017b, and 2017c) pertinent to the method and the applicable QC measurement data reported will be reviewed

and qualification of the data will be completed, as necessary, based on method-specific and laboratory-established control limits.

Results for field splits will be evaluated against a control limit of 50 relative percent difference (RPD). Data will not be qualified as estimated if this control limit is exceeded, but RPD results will be tabulated, and any exceedances will be discussed in the applicable site characterization summary report for each sampling event. Equipment rinsate blanks will be evaluated and data qualifiers will be applied in the same manner as method blanks, as described in the applicable EPA guidance documents for data review (EPA, 2002; EPA, 2016; EPA, 2017b; EPA 2017c).

Analytical data that do not meet established control limits for applicable QC measurements will be qualified as estimated (J) by the laboratory or during the data validation. Results that are reported as detected at a concentration above the MDL or EDL, but below the MRL, also will be qualified as estimated (J). Data qualified as estimated (J) may be considered usable and may be of good quality, yet have a degree of uncertainty (i.e., may be less precise or less accurate than unqualified data). J-qualified data may be used in conjunction with non-qualified data when making remedial decisions. Analytical data that are reported as undetected (U) by the laboratory or that are restated as undetected (U) during data validation, are acceptable and are usable. Data will be rejected if control limits for acceptance of data are not met, as described in EPA guidance documents (2002, 2016, 2017b, and 2017c). Any data that were rejected (R) during data validation will not be used for any purpose.

Completeness will be calculated as the ratio of usable data (i.e., unqualified data and U-, J-, or N-qualified data) to generated data, expressed as a percentage. Completeness will be calculated for each suite of analytes for each sample type and sampling event. A completeness criterion of 100 percent is targeted for this project, both in terms of the number of planned samples compared with the number of samples actually collected, and in terms of the number of rejected compared with non-rejected analytical results. Given the unpredictable nature of issues that may arise during field work, samples may not be collected successfully from all locations. Any significant deviations from the proposed sampling locations will be discussed with the EPA Remedial Project Manager as specified in the SAP and documented in the Field Sampling and Data Report. If analytical results are rejected (R) during data validation, a completeness criterion of 95 percent may be acceptable.

The findings of the data validation review will be presented in a Data Validation Review Memorandum that will be appended to the Field Sampling and Data Report. Final qualified (as necessary) laboratory results will be transmitted in electronic format to the Data Manager for data management, further evaluation, and reporting.

This page intentionally left blank.

6. References

DOF and GSI. 2019. Basis of Design Report, River Mile 11 East. Prepared for RM11E Group by Dalton Olmsted & Fuglevand, Inc., and GSI Water Solutions, Inc.; with David Evans and Associates, Inc.; Geotechnical Resources, Inc.; Grette Associates LLC; KPFF Consulting Engineers; and Mott MacDonald.

EPA. 2002. Guidance on Environmental Data Verification and Data Validation. EPA QA/G-8. EPA/240/R-02/004, U.S. Environmental Protection Agency (EPA), Office of Environmental Information, Washington, DC. November 2002.

EPA. 2006. USEPA Guidance in Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4. United States Environmental Protection Agency, Office of Environmental Information Washington, DC.

EPA. 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. OSWER No. 9200.1-85. EPA 540-R-08-005. January 13, 2009. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

EPA 2016. National Functional Guidelines for High Resolution Superfund Methods Data Review. OLEM 9200.3-115. EPA 542-B-16-001. April 2016. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, DC.

EPA. 2017a. Portland Harbor Superfund Site Record of Decision, Portland, Oregon. U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA. 2017b. National Functional Guidelines for Inorganic Data Superfund Data Review. Final. OLEM 9355.0-135. EPA-540-R-2017-001. U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, DC. January 2017.

EPA. 2017c. National Functional Guidelines for Organic Superfund Methods Data Review. Final. OLEM 9355.0-136. USEPA-540-R-2017-002. U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, DC. June 2017.

EPA. 2019. Final Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon. U.S. Environmental Protection Agency Region 10, Seattle, Washington. December 9, 2019.

GSI. 2009. Sampling and Analysis Plan, River Mile 11 East Focused Sediment Characterization. Prepared for the Oregon Department of Environmental Quality. Prepared by GSI Water Solutions, Inc. May 1, 2009.

GSI and DOF. 2013 RM11E Final Supplemental Remedial Investigation/Feasibility Study Work Plan River Mile 11 East, Portland, Oregon. Prepared by GSI Water Solutions, Inc., and Dalton Olmsted & Fuglevand, Inc.

ITRC. 2020. Clarifications to ITRC 2012 ISM-1 Guidance, January 22, 2020. Prepared by the Interstate Technology & Regulatory Council Team Leaders and Program Advisor of the ISM-2 Update Team.

RSET. 2018. Sediment Evaluation Framework for the Pacific Northwest. Prepared by the Northwest Regional Sediment Evaluation Team (RSET) Agencies: U. S. Army Corps of Engineers, U.S. Environmental Protection Agency, NOAA Fisheries, U.S. Fish and Wildlife Service, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, Washington Department of Ecology, Washington Department of Natural Resources. May 2018.

USACE. 2003. Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities — Testing Manual. ERDC/EL TR-01-1. U.S. Army Corps of Engineers Research and Development Center.

Tables

This page intentionally left blank.

Table 1-1
Project Staff Contact Information

Project Role	Name/Affiliation	Phone Numbers	Email Address
Program Manager	Paul Fuglevand, PE/DOF	O: (425) 827-4588 C: (206) 660-3079	pfuglevand@dofnw.com
Lead Engineer	Connor Lamb, PE/DOF	C: (360) 977-8056	clamb@dofnw.com
Field Investigation Project Director	David Livesay, RG/GSI	O: (971) 299-8501 C: (541) 868-5777	dlivesay@gsiws.com
Field Investigation Project Manager	Alison Clements/GSI	O: (971) 200-8528 C: (503) 801-5565	aclements@gsiws.com
Sampling and Analysis Coordinator	Benjamin Johnson, RG, LHG/GSI	O: (971) 200-8520 C: (503) 679-4543	bjohnson@gsiws.com
Field Safety Officer	John Gauthier/GSI	O: (971) 200-8529 C: (805) 816-3823	jgauthier@gsiws.com
Data Validation	James Mc Ateer/QA/QC Solutions, LLC	O: (503) 763-6948 C: (503) 881-1501	(b) (6)
Laboratory Project Manager	Lisa Domenighini/APEX Laboratories, LLC	O: (503) 718-2323 D: (503) 747-6168	ldomenighini@apex-labs.com
SPI Survey, Surface Sediment, and Vibracore Sampling Contractor	David Browning/Marine Sampling System, LLC	C: (360) 701-9596	(b) (6)
Sonic Core Marine Contractor	Kurt Redd/Diversified Marine, Inc.	O: (503) 289-2669 C: (503) 969-4593	kurt@dmipdx.com
Sonic Core Sampling Contractor	Ron Rider/Cascade Drilling	O: (253) 883-5200 C: (253) 293-1910	RRider@cascade-env.com
Sub-bottom Profiling Contractor	Nick Lesnikowski/David Evans and Associates, Inc.	C: (206) 419-4595	nick.lesnikowski@deainc.com
Cultural Resources	David Ellis/Willamette Cultural Resources Associates, Ltd.	O: (503) 281-4576	davee@willamettecra.com

Notes
DOF = Dalton, Olmsted & Fuglevand, Inc.
GSI = GSI Water Solutions, Inc.
PE = Professional Engineer
RG = Registered Geologist
TBD = to be determined

Table 2-1
Sampling Locations Within Each Sample Area

Sample Area	Station ID	
	Sediment Cores	***Sediment Grabs***
Area 1	C050 to C073	G100 to G107
Area 2	C074 to C081	G108 to G110
Area 3	C082 to C099	G111 to G116
Area 4	C100 to C108	G117
Area 5	NA	G118 to G122[1]
Area 6	C109 to C113	NA

Notes

[1] Two samples from Area 5 (G118 and G119) are above +13 NAVD 88. These are grouped with other Area 5 samples as surface sediment grabs for organizational purposes only.

NA = not applicable
NAVD 88 = North American Vertical Datum of 1988

Table 2-2
Surface Sediment Sample Analytes

Sample Area	Parameter	Analytical Method
1 and 4	PCB Aroclors	8082A
	PCDD/Fs	1613B
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD[2]
	Grain Size	D422mod[3]
2[1] and 3	PCB Aroclors	8082A
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD[2]
	Grain Size	D422mod[3]
5	PCDD/Fs	1613B
	Total Solids	SM 2540G
	TOC	SM 5310 B MOD[2]
	Grain Size	D422mod[3]

Notes

[1] One sample (G110) will also be analyzed for DDx (EPA Method 1699M) as per Section 3 of the SAP.

[2] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) for high-temperature combustion followed by nondispersive infrared detection.

[3] In order to maintain comparability with all previous grain size data reported, D422mod will continued to be used despite being considered a withdrawn method. The modifications are that the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no. 10 sieve).

µm = micrometer
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
mm = millimeter
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PSEP = Puget Sound Estuary Protocols
SAP = Sampling and Analysis Plan
TOC = total organic carbon

Table 2-3
Subsurface Sediment Sample Tiered Analytical Program for Areas 1 through 4

Sample Tier and Description	Analyte Group	Parameter	Analytical Method
All Samples: Tiers 1, 2, 3	Physical Parameters	Atterberg Limits[1]	ASTM D4318
		Total Solids	SM 2540 G
		TOC	SM 5310 B MOD[2]
		Grain Size	D422mod[3]
Tier 1: Determine DOC by PCBs	PCB Aroclors	PCB Aroclors	8082A
Tier 2: Confirm DOC	Tier 1 + PCDD/Fs	PCDD/Fs	1613B
Tier 3: Document Leave Surface by ROD Table 17 COCs	Tier 2 + remaining ROD Table 17 COCs	Aldrin	1699M
		Arsenic	6020A
		BEHP	8270D
		Cadmium	6020A
		Chlordanes[4]	1699M
		Copper	6020A
		4,4'- and 2,4'-DDD	1699M
		4,4'- and 2,4'-DDE	1699M
		4,4'- and 2,4'-DDT	1699M
		Dieldrin	1699M
		Lindane	1699M
		Lead	6020A
		Mercury	6020A
		PAHs	8270D
		cPAHs (BaP eq)	8270D
		TPH-Diesel	NWTPH-Dx
		Tributyltin	Krone
		Zinc	6020A

Notes

[1] Atterberg Limit tests will be conducted on 10–15 representative fine-grained samples, to be determined in the field.

[2] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) for high-temperature combustion followed by nondispersive infrared detection.

[3] In order to maintain comparability with all previous grain size data reported, D422mod will continued to be used despite being considered a withdrawn method. The modifications are that the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no. 10 sieve).

[4] Total chlordanes include the following analytes: cis-chlordane, trans-chlordane, trans-nonachlor, cis-nonachlor, oxychlordane.

µm = micrometer
BaP eq = benzo(a)pyrene equivalents
BEHP = bis(2-ethylhexyl)phthalate
COCs = contaminants of concern
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
mm = millimeter
PAHs = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
PCDD/Fs = polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PSEP = Puget Sound Estuary Protocols
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)
TOC = total organic carbon
TPH = total petroleum hydrocarbons

Table 3-1
Bulk Sediment Sample Analytes

Analyte Group	Parameter	Analytical Method
Physical Parameters	TOC	ASTM D4129-05
	Grain size	ASTM D422
TCLP	Lead	EPA 1311/6020A
	Chromium	
Jar tests (treatability and water clarification testing)	TSS	SM2540-D
	TDS	SM2540-C
	TOC	SM5310-C
	Cations[1]	6010C
	Anions[2]	300.0; SM4500 S2-D
	Hardness	6010C-calc
	pH	SM4500 H+B
Bench testing	Paint filter testing	EPA SW-846 Test Method 9095B
	Slump testing	NA
	Admixture testing	NA

Notes
[1] Calcium (Ca), magnesium (Mg), potassium (K), sodium (Na)
[2] Chlorine (Cl), sulfate (SO_4), nitrite (NO_{2-}), nitrate (NO_3), phosphate (PO_4)

NA = not applicable
PCB = polychlorinated biphenyl
TCLP = toxicity characteristic leaching procedure
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids

Table 3-2
DRET Bulk Water Sample Analytes

Analyte Group	Parameter	Analytical Method
ROD Table 17 - Surface Water COCs	Aldrin	8081B
	Arsenic	6020A
	BEHP	8270D
	Chlordanes	8081B
	Chromium	6020A
	Copper	6020A
	DDx	8081B
	4,4'- and 2,4'-DDD	8081B
	4,4'- and 2,4'-DDE	8081B
	4,4'- and 2,4'-DDT	8081B
	Ethylbenzene	8260
	Hexachlorobenzene	8081B
	MCPP	8151A
	Pentachlorophenol	8270D
	PCB Aroclors	8082A
	cPAHs (BaP eq)	8270D
	Benzo(a)anthracene	8270D
	Benzo(a)pyrene	8270D
	Benzo(b)fluoranthene	8270D
	Benzo(k)fluoranthene	8270D
	Chrysene	8270D
	Dibenz(a,h)anthracene	8270D
	Indeno(1,2,3-c,d)pyrene	8270D
	Naphthalene	8270D
	Dioxins/Furans (2,3,7,8-TCDD eq)	8290
	Tributyltin	ALS-SOP
	Zinc	6020

Notes

BaP eq = benzo(a)pyrene equivalents
BEHP = bis(2-ethylhexyl)phthalate
COCs = contaminants of concern
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
DRET = Dredge Elutriate Test
eq = equivalent
MCPP = 2-(4-chloro-2-methylphenoxy)propanoic acid
PCB = polychlorinated biphenyl
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)
TCDD = tetrachlorodibenzo-p-dioxin

Table 4-1
Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Surface Sediment Samples

Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[1]	Nearshore/Nav Channel RALs[2]	Laboratory EDLs[3]	Achievable Laboratory MDLs[3]	Laboratory MRLs[3]	Units	MS/MSD[4]		LCS/LCSD	
										Percent Recovery (%)	RPD (%)	Percent Recovery (%)	RPD (%)
Polychlorinated Biphenyls													
Aroclor 1016	12674-11-2	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	47-134	30	47-134	30
Aroclor 1221	11104-28-2	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1232	11141-16-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1242	53469-21-9	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1248	12672-29-6	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1254	11097-69-1	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1260	11096-82-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	53-140	30	53-140	30
Aroclor 1262	37324-23-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1268	11100-14-4	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Total PCBs (summation)	-	APEX	8082A	9.0	75 / 200	-	-	-	µg/kg dry wt	-	-	-	-
Dioxin/Furans													
Dioxins/Furans (2,3,7,8 TCDD eq)	-	Cape Fear	1613B	0.0100	-	-	-	-	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	Cape Fear	1613B	0.0004	-	0.0000673	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	Cape Fear	1613B	0.0002	0.0008 / 0.003	0.0000708	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	Cape Fear	1613B	0.0003	0.2 / 1.0	0.0000607	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	Cape Fear	1613B	-	-	0.001000	0.00333	0.0100	µg/kg dry wt	-	-	-	-
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	Cape Fear	1613B	-	-	0.001000	0.00333	0.0100	µg/kg dry wt	-	-	-	-
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	Cape Fear	1613B	0.0004	-	0.000112	0.000333	0.001	µg/kg dry wt	-	-	-	-
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	Cape Fear	1613B	0.0002	0.0006 / 0.002	0.000121	0.000333	0.001	µg/kg dry wt	-	-	-	-
Demand Parameters													
Total Organic Carbon	TOC	APEX	SM 5310 B MOD[5]	-	-	-	200	200	mg/kg	-	-	90-110	-
Solid and Moisture Determinations													
Total Solids	TS	APEX	SM 2540 G	-	-	-	1.00	1.00	% by Weight	-	-	-	-
Grain Size													
Gravel (>2.00 mm)	GS-Gravel	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Sand (0.063 mm - 2.00 mm)	GS-Sand	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Silt (0.005 mm < 0.063 mm)	GS-SILT	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Clay (< 0.005 mm)	GS-Clay	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 4.75 mm sieve (#4)	GS-4.75	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 2.00 mm sieve (#10)	GS-2.00	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.85 mm sieve (#20)	GS-0.850	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.425 mm sieve (#40)	GS-0.425	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.250 mm sieve (#60)	GS-0.250	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.150 mm sieve (#100)	GS-0.150	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.106 mm sieve (#140)	GS-0.106	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.075 mm sieve (#200)	GS-0.075	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.063 mm sieve (#230)	GS-0.063	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-

Notes
[1] From Table 17 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017).
[2] From Table 21 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) as modified by the ESD dated December 9, 2019.
[3] EDLs, MDLs, and MRLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

Table 4-1
Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Surface Sediment Samples

[4] Surrogate analytes Percent Recovery and RPD are presented in MS/MSD column.

[5] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) for high-temperature combustion followed by nondispersive infrared detection.

[6] In order to maintain comparability with all previous grain size data reported, D422mod will continued to be used despite being considered a withdrawn method. The modifications are that the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no. 10 sieve).

µg/kg = micrograms per kilogram
µm = micrometer
CAS = Chemical Abstract Service
eq = equivalent
EDL = estimated detection limit
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MDL = method detection limit
mg/kg = milligrams per kilogram
mm = millimeter
MRL = method reporting limit
MS = matrix spike
MSD = matrix spike duplicate
PCBs = polychlorinated biphenyls
ROD = Record of Decision
RPD = relative percent difference
TOC = total organic carbon
TS = total solids
wt = weight

Table 4-2
Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Subsurface Sediment Samples

Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[1]	Nearshore/Nav Channel RALs[2]	Laboratory EDLs[3]	Achievable Laboratory MDLs[3]	Laboratory MRLs[3]	Units	MS/MSD[4]		LCS/LCSD	
										Percent Recovery (%)	RPD (%)	Percent Recovery (%)	RPD (%)
Polychlorinated Biphenyls													
Aroclor 1016	12674-11-2	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	47-134	30	47-134	30
Aroclor 1221	11104-28-2	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1232	11141-16-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1242	53469-21-9	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1248	12672-29-6	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1254	11097-69-1	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1260	11096-82-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	53-140	30	53-140	30
Aroclor 1262	37324-23-5	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Aroclor 1268	11100-14-4	APEX	8082A	-	-	-	2.00	4.00	µg/kg dry wt	-	-	-	30
Total PCBs (summation)	-	APEX	8082A	9.0	75 / 200	-	-	-	µg/kg dry wt	-	-	-	-
Dioxin/Furans													
Dioxin/Furans (2,3,7,8 TCDD eq)	-	Cape Fear	1613B	0.0100	-	-	-	-	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	Cape Fear	1613B	0.0004	-	0.0000673	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	Cape Fear	1613B	0.0002	0.0008 / 0.003	0.0000708	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	Cape Fear	1613B	-	-	0.000500	0.00167	0.00500	µg/kg dry wt	-	-	-	-
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	Cape Fear	1613B	0.0003	0.2 / 1.0	0.0000607	0.001670	0.005	µg/kg dry wt	-	-	-	-
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	Cape Fear	1613B	-	-	0.001000	0.00333	0.0100	µg/kg dry wt	-	-	-	-
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	Cape Fear	1613B	-	-	0.001000	0.00333	0.0100	µg/kg dry wt	-	-	-	-
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	Cape Fear	1613B	0.0004	-	0.000112	0.000333	0.001	µg/kg dry wt	-	-	-	-
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	Cape Fear	1613B	0.0002	0.0006 / 0.002	0.000121	0.000333	0.001	µg/kg dry wt	-	-	-	-
Organochlorine Pesticides													
Aldrin	309-00-2	Maxxam	1699M	2.0	-	-	0.011	0.05	µg/kg dry wt	45-136	30	45-136	30
Chlordane-Total* include * following analytes	-	Maxxam	1699M	1.4	-	-	-	-	µg/kg dry wt	43-149	30	43-149	30
cis-chlordane	5103-71-9	Maxxam	1699M	1.4	-	-	0.003	0.05	µg/kg dry wt	54-133	30	54-133	30
trans-chlordane	5103-74-2	Maxxam	1699M	1.4	-	-	0.005	0.05	µg/kg dry wt	53-135	30	53-135	30
trans-nonachlor	-	Maxxam	1699M	1.4	-	-	0.003	0.05	µg/kg dry wt	-	-	-	-
cis-nonachlor	5103-73-1	Maxxam	1699M	1.4	-	-	0.008	0.05	µg/kg dry wt	-	-	-	-
oxychlordane	27304-13-8	Maxxam	1699M	1.4	-	-	0.003	0.05	µg/kg dry wt	61-132	30	61-132	30
Dieldrin	60-57-1	Maxxam	1699M	0.07	-	-	0.008	0.05	µg/kg dry wt	56-136	30	56-136	30
gamma-BHC (Lindane)	58-89-9	Maxxam	1699M	5.0	-	-	0.004	0.05	µg/kg dry wt	49-135	30	49-135	30
4,4'-DDD	72-54-8	Maxxam	1699M	114	-	-	0.008	0.05	µg/kg dry wt	56-139	30	56-139	30
4,4'-DDE	72-55-9	Maxxam	1699M	50	-	-	0.004	0.05	µg/kg dry wt	56-134	30	56-134	30
4,4'-DDT	50-29-3	Maxxam	1699M	246	-	-	0.005	0.05	µg/kg dry wt	50-141	30	50-141	30
2,4'-DDD	53-19-0	Maxxam	1699M	114	-	-	0.004	0.05	µg/kg dry wt	75-130	30	75-130	30
2,4'-DDE	3424-82-6	Maxxam	1699M	50	-	-	0.004	0.05	µg/kg dry wt	74-131	30	74-131	30
2,4'-DDT	789-02-6	Maxxam	1699M	246	-	-	0.005	0.05	µg/kg dry wt	64-136	30	64-136	30
DDx (summation)	-	Maxxam	1699M	6.1	160 / 650	-	-	-	µg/kg dry wt	-	-	-	-
Hexachlorobenzene	118-74-1	Maxxam	1699M	NA	-	-	0.011	0.05	µg/kg dry wt	57-126	30	57-126	30
Semivolatile Organic Compounds													
Total PAHs	83-32-9	APEX	8270D	23000	30000 / 170000	-	2	4	µg/kg dry wt	45-132	30	45-132	30
cPAH (BaP eq)		APEX	8270D	774	-	-	2	4	µg/kg dry wt	45-132	30	45-132	30
Naphthalene	91-20-3	APEX	8270D	NA	-	-	2.67	5.33	µg/kg dry wt	35-123	30	35-123	30
Bis(2-ethylhexyl)phthalate	117-81-7	APEX	8270D	135	-	-	20.0	40.0	µg/kg dry wt	51-133	30	51-133	30

Table 4-2
Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in Targeted SMA Subsurface Sediment Samples

Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[1]	Nearshore/Nav Channel RALs[2]	Laboratory EDLs[3]	Achievable Laboratory MDLs[3]	Laboratory MRLs[3]	Units	MS/MSD[4]		LCS/LCSD	
										Percent Recovery (%)	RPD (%)	Percent Recovery (%)	RPD (%)
Total Metals													
Arsenic	7440-38-2	APEX	6020A	3.0	-	-	0.250	0.500	mg/kg dry wt	75-125	40	80-120	20
Cadmium	7440-43-9	APEX	6020A	0.51	-	-	0.0500	0.100	mg/kg dry wt	10-150	40	80-120	20
Chromium	7440-47-3	APEX	6020A	NA	-	-	0.250	0.500	mg/kg dry wt	75-125	40	80-120	20
Copper	7440-50-8	APEX	6020A	359	-	-	0.250	0.500	mg/kg dry wt	75-125	40	80-120	20
Lead	7439-92-1	APEX	6020A	196	-	-	0.0500	0.100	mg/kg dry wt	75-125	40	80-120	20
Mercury	7439-97-6	APEX	6020A	0.085	-	-	0.0200	0.0400	mg/kg dry wt	75-125	40	80-120	20
Zinc	7440-66-6	APEX	6020A	459	-	-	1.00	2.00	mg/kg dry wt	75-125	40	80-120	20
Diesel and/or Oil Hydrocarbons													
Diesel	68334-30-5	APEX	NWTPH-Dx	91	-	-	10.0	20.0	mg/kg dry wt	50-150	50	76-115	20
Other Constituents													
Tributyltin	-	Eurofins	Krone et al.	3080	-	-	1.4872	3	µg/kg dry wt	10-150	30	10-150	30
Total Organic Carbon	TOC	APEX	SM 5310 B MOD[5]	-	-	-	200	200	mg/kg	-	-	90-110	-
Solid and Moisture Determinations													
Total Solids	TS	APEX	SM 2540 G	-	-	-	1.00	1.00	% by Weight	-	-	-	-
Grain Size													
Gravel (>2.00 mm)	GS-Gravel	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Sand (0.063 mm - 2.00 mm)	GS-Sand	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Silt (0.005 mm < 0.063 mm)	GS-SILT	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Clay (< 0.005 mm)	GS-Clay	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 4.75 mm sieve (#4)	GS-4.75	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 2.00 mm sieve (#10)	GS-2.00	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.85 mm sieve (#20)	GS-0.850	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.425 mm sieve (#40)	GS-0.425	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.250 mm sieve (#60)	GS-0.250	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.150 mm sieve (#100)	GS-0.150	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.106 mm sieve (#140)	GS-0.106	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.075 mm sieve (#200)	GS-0.075	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-
Percent Retained 0.063 mm sieve (#230)	GS-0.063	APEX	D422mod[6]	-	-	-	0.0100	0.0100	% of Total	-	-	-	-

Notes

[1] From Table 17 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) as modified by the Final Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon (EPA, 2019).

[2] From Table 21 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) as modified by the Final Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon (EPA, 2019).

[3] EDLs, MDLs, and MRLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

[4] Surrogate analytes Percent Recovery and RPD are presented in MS/MSD column.

[5] Modification is to use PSEP 1997 specified sample preparation (i.e., sample drying, homogenization, and acidification to remove inorganic carbon) nfor high-temperature combustion followed by nondispersive infrared detection.

[6] In order to maintain comparability with all previous grain size data reported D422mod will continued to be used despite being considered a withdrawn method. The modifications are that the break between fines (silts and clay) and very fine sand is 63 µm (ASTM no. 230 sieve), and the break between very coarse sand and gravels (and coarser material) is 2 mm (ASTM no. 10 sieve).

µg/kg = micrograms per kilogram
µm = micrometer
CAS = Chemical Abstract Service
cPAH = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
EDL = estimated detection limit
ESD = Final Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon (EPA, 2019)
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MDL = method detection limit
mg/kg = milligrams per kilogram
mm = millimeter
MRL = method reporting limit
MS = matrix spike
MSD = matrix spike duplicate
Nav Channel = Navigation Channel
PAH = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
ROD = Record of Decision
RPD = relative percent difference
TOC = total organic carbon
TS = total solids
wt = weight

Table 4-3
Cleanup Levels and Analytical Quantitation Limits for Chemicals of Potential Concern in DRET and Bulk Water Samples

							MS/MSD[3]		LCS/LCSD	
Parameter	CAS Number	Laboratory	Method	ROD Cleanup Levels[1]	Laboratory MRLs[2]	Units	Percent Recovery (%)	RPD (%)	Percent Recovery (%)	RPD (%)
Polychlorinated Biphenyls										
Aroclor 1016	12674-11-2	ALS	8082	-	0.2	µg/L	41-113	30	41-113	30
Aroclor 1221	11104-28-2	ALS	8082	-	0.4	µg/L	-	-	-	-
Aroclor 1232	11141-16-5	ALS	8082	-	0.2	µg/L	-	-	-	-
Aroclor 1242	53469-21-9	ALS	8082	-	0.2	µg/L	-	-	-	-
Aroclor 1248	12672-29-6	ALS	8082	-	0.2	µg/L	-	-	-	-
Aroclor 1254	11097-69-1	ALS	8082	-	0.2	µg/L	-	-	-	-
Aroclor 1260	11096-82-5	ALS	8082	-	0.2	µg/L	47-117	30	47-117	30
Aroclor 1262	37324-23-5	ALS	8082	-	0.2	µg/L	-	-	-	-
Aroclor 1268	11100-14-4	ALS	8082	-	0.2	µg/L	-	-	-	-
Total PCBs (summation)	-	ALS	8082	0.0000064	0.05	µg/L	-	-	-	-
Dioxin/Furans										
Dioxins/Furans (2,3,7,8-TCDD eq)	1746-01-6	ALS	8290	0.0000000005	0.000005	µg/L	70-130	25	70-130	25
Organochlorine Pesticides and Herbicides										
Aldrin	309-00-2	ALS	8081	0.00000077	0.001	µg/L	54-163	30	54-163	30
Chlordane-Total* include * following analytes	-	ALS	8081	0.000081	0.002	µg/L	27-172	30	27-172	30
cis-chlordane	5103-71-9	ALS	8081	-	0.001	µg/L	62-173	30	62-173	30
trans-chlordane	5103-74-2	ALS	8081	-	0.001	µg/L	67-168	30	67-168	30
trans-nonachlor	-	ALS	8081	-	0.001	µg/L	63-144	30	63-144	30
cis-nonachlor	5103-73-1	ALS	8081	-	0.001	µg/L	62-142	30	62-142	30
oxychlordane	27304-13-8	ALS	8081	-	0.001	µg/L	54-134	30	54-134	30
4,4'-DDD	72-54-8	ALS	8081	0.000031	0.001	µg/L	73-173	30	73-173	30
4,4'-DDE	72-55-9	ALS	8081	0.000018	0.001	µg/L	70-169	30	70-169	30
4,4'-DDT	50-29-3	ALS	8081	0.000022	0.001	µg/L	72-174	30	72-174	30
2,4'-DDD	53-19-0	ALS	8081	0.000031	0.001	µg/L	28-173	30	28-173	30
2,4'-DDE	3424-82-6	ALS	8081	0.000018	0.001	µg/L	37-182	30	37-182	30
2,4'-DDT	789-02-6	ALS	8081	0.000022	0.001	µg/L	29-179	30	29-179	30
DDx (summation)	-	ALS	8081	0.01	0.006	µg/L	-	-	-	-
Hexachlorobenzene	118-74-1	ALS	8081	0.000029	0.001	µg/L	51-132	30	52-132	30
MCPP	93-65-2	ALS	8151	16	100	µg/L	16-141	30	16-141	30
Pentachlorophenol	87-86-5	ALS	8270	0.03	25	µg/L	35-113	30	35-113	30
Semivolatile Organic Compounds										
Benzo(a)anthracene	56-55-3	ALS	8270	0.0012	10	µg/L	55-106	30	55-106	30
Benzo(a)pyrene	50-32-8	ALS	8270	0.00012	10	µg/L	52-104	30	52-104	30
Benzo(b)fluoranthene	205-99-2	ALS	8270	0.0012	10	µg/L	50-107	30	50-107	30
Benzo(k)fluoranthene	207-08-9	ALS	8270	0.0013	10	µg/L	52-107	30	52-107	30
Bis(2-ethylhexyl)phthalate (BEHP)	117-81-7	ALS	8270	0.2	10	µg/L	49-114	30	49-114	30
Chrysene	218-01-9	ALS	8270	0.0013	10	µg/L	51-102	30	51-102	30
cPAH (BaP eq)	-	ALS	8270	0.00012	80	µg/L	-	-	-	-
Dibenz(a,h)anthracene	53-70-3	ALS	8270	0.00012	10	µg/L	56-109	30	56-109	30
Ethylbenzene	100-41-4	ALS	8260	7.3	0.5	µg/L	67-121	30	67-121	30
Indeno(1,2,3-c,d)pyrene	193-39-5	ALS	8270	0.0012	10	µg/L	56-108	30	56-108	30
Naphthalene	91-20-3	ALS	8270	12	10	µg/L	46-98	30	46-98	30
Total Metals										
Arsenic	7440-38-2	ALS	6020	0.018	0.5	µg/L	80-120	20	80-120	20
Chromium	7440-47-3	ALS	6020	100	0.2	µg/L	80-120	20	80-120	20
Copper	7440-50-8	ALS	6020	2.74	0.1	µg/L	80-120	20	80-120	20
Zinc	7440-66-6	ALS	6020	36.5	2	µg/L	80-120	20	80-120	20
Other Constituents										
Tributyltin	NA	ALS	ALS-SOP	0.063	0.05	µg/L	32-122	30	32-122	30

Notes

[1] From Table 17 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) as modified by the ESD dated December 9, 2019.

[2] EDLs, MDLs, and MRLs were provided by the laboratory. These are presented for informational purposes only. Data review/validation will be based on the most current precision and accuracy limits in effect at the time of analysis.

[3] Surrogate analytes Percent Recovery and RPD are presented in MS/MSD column.

µg/L = micrograms per liter
CAS = Chemical Abstract Service
cPAH = carcinogenic polycyclic aromatic hydrocarbons
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
DDx = The sum of 2,4' and 4,4' - DDD, DDE, and DDT
DRET = Dredge Elutriate Test
EDL = estimated detection limit
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
MCPP = 2-(4-chloro-2-methylphenoxy)propanoic acid
MDL = method detection limit
mg/kg = milligrams per kilogram
mm = millimeter
MRL = method reporting limit
MS = matrix spike
MSD = matrix spike duplicate
RPD = relative percent difference
ROD = Portland Harbor Superfund Site Record of Decision (EPA, 2017)

Table 4-4

Sample Extraction Methods

Laboratory Test Method	Laboratory Preparation Method
Metals by EPA Method 6020A	EPA Method 3051A
BEHP by EPA Method 8270D	EPA Method 3546
PCB by EPA Method 8082	EPA Method 3546
NWTPH Dx	EPA Method 3546-Fuels
Total Solids by SM 2540G	METHOD
TOC by SM 5310B	METHOD
Grain Size by ASTM D422M	METHOD
Chlorobenzene by EPA Method 8260C	EPA Method 5035A
Naphthalene by EPA Method 8260	EPA Method 5035A
PAH by EPA Method 8270 SIM	EPA Method 3546
TCLP Metals by EPA Method 1311/6020	EPA Method 1311/3015
Pesticides by EPA 1699M	BV/Maxxam SOP
Dioxin/Furans by EPA Method 1613B	METHOD
TBT by Krone	METHOD

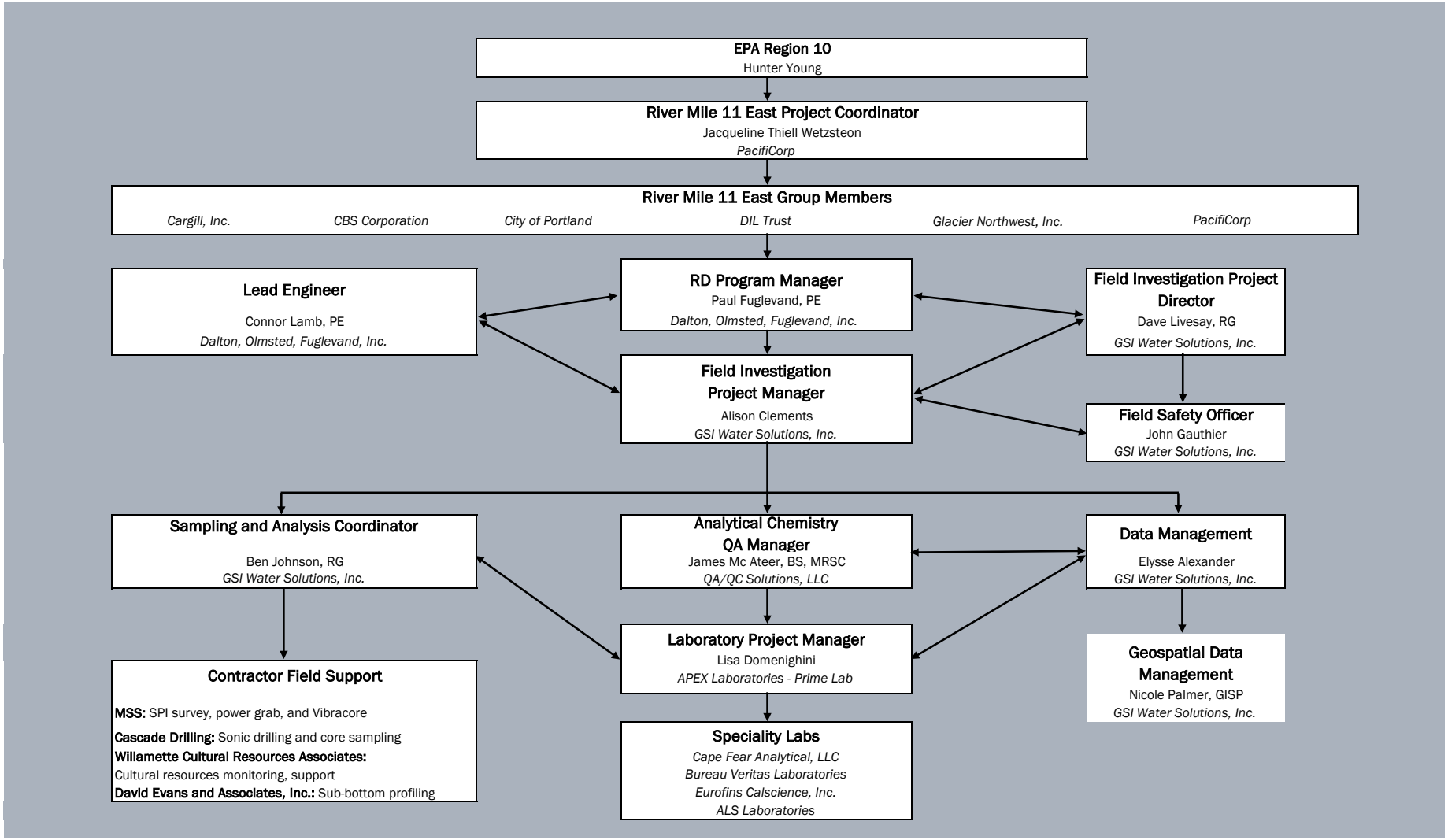
Notes

BEHP = bis(2-ethylhexyl)phthalate
BV = Bureau Veritas
EPA = U.S. Environmental Protection Agency
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SOP = standard operating procedure
TBT = tributyltin
TCLP = toxicity characteristic leaching procedure
TOC = total organic carbon

Figures

This page intentionally left blank.

Figure 1. Phase I RD Sampling Organizational Chart



This page intentionally left blank.

Figure 2 APEX Laboratories Chain-of-Custody Form

APEX LABS CHAIN OF CUSTODY

Lab # _____ COC ____of____

6700 SW Sandburg St., Tigard, OR 97223 Ph: 503-718-2323

Company:	Project Mgr:	Project Name:	Project #:
Address:	Phone:	Email:	PO #
Sampled by:			

ANALYSIS REQUEST

Site Location: OR WA CA AK ID ____ SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	**NWTPH-HCID**	**NWTPH-Dx**	**NWTPH-Gx**	**8260 BTEX**	**8260 RBDM VOCs**	**8260 Halo VOCs**	**8260 VOCs Full List**	**8270 SIM PAHs**	**8270 Semi-Vols Full List**	**8082 PCBs**	**8081 Pest**	**RCRA Metals (8)**	**Priority Metals (13)**	**Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn** TOTAL DISS. TCLP	**TCLP Metals (8)**							**Archive**

Normal Turn Around Time (TAT) = 10 Business Days

TAT Requested (circle) **1 Day** **2 Day** **3 Day** **4 DAY** **5 DAY** **Other: _____**

SPECIAL INSTRUCTIONS:

SAMPLES ARE HELD FOR 30 DAYS

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
Signature: Date:	Signature: Date:	Signature: Date:	Signature: Date:
Printed Name: Time:	Printed Name: Time:	Printed Name: Time:	Printed Name: Time:
Company:	Company:	Company:	Company:

Attachments

The laboratory quality assurance documents for this QAPP are protected from alteration and therefore provided to EPA as separate electronic files.

APPENDIX C

Data Quality Management Plan

Page left blank intentionally.

Appendix C
Phase I Remedial Design Data Quality Management Plan

River Mile 11 East
Portland, Oregon

Prepared for

RM11E Group

May 2020

Prepared by

GSI Water Solutions, Inc.

Page left blank intentionally.

Contents

1. Introduction C-1
   1.1 Project Area Description C-1
   1.2 Purpose and Objectives C-1
   1.3 Data Management Roles and Responsibilities C-2
2. Data Management System Architecture C-3
   2.1 Project Software and Hardware C-3
   2.2 Data Management System Architecture C-3
   2.3 Data Management System Security, Access, and Recovery Plan C-3
3. Tabular Data Management C-5
   3.1 Relational Database Management System C-5
      3.1.1 Enviro Data Database Model C-5
      3.1.2 Database Nomenclature C-6
      3.1.3 Field Data Standards C-6
      3.1.4 Lab Electronic Data Deliverable Standards C-6
      3.1.5 Scribe.NET Standards C-7
   3.2 Integrating Historical Data C-7
      3.2.1 Pre-remedial Design Investigation MS Access Historical Database C-7
      3.2.2 Additional Historical Data Integration C-7
   3.3 Tabular Data Quality Assurance C-8
      3.3.1 Historical Data Quality Control Procedures C-8
      3.3.2 Field Data Quality Control Procedures C-8
      3.3.3 Lab Data Submittal Quality Control Procedures C-8
4. Geospatial Data Management C-9
   4.1 Geodetic Specifications and Data Quality C-9
      4.1.1 Vertical Datum C-9
      4.1.2 Horizontal Datum C-9
      4.1.3 Coordinate System C-9
      4.1.4 Data Precision C-10
      4.1.5 Data Accuracy C-11
   4.2 Geospatial Data Model C-12
      4.2.1 Historical Spatial Data C-12
      4.2.2 New Spatial Data Derivatives C-13

4.3 Geospatial Data Quality Assurance C-13
4.3.1 Quality Control Procedures C-13
5. Unstructured Data Management C-15
5.1 Unstructured Data Standards C-15
5.1.1 Reports and Memos C-15
5.1.2 Presentations C-15
5.1.3 Maps C-15
5.1.4 Email Correspondences C-15
5.1.5 Other Unstructured Data C-15
5.2 Unstructured Data Model C-16
5.2.1 File System Storage C-16
5.2.2 SharePoint Document Management C-16
5.3 Unstructured Data Quality Assurance C-17
5.3.1 Quality Control of Reports and Memos C-17
5.3.2 Quality Control of Maps C-17
5.3.3 Quality Control of Other Unstructured Data C-18
6. Data Documentation C-19
6.1 Tabular Data Metadata C-19
6.2 Geospatial Data Metadata C-19
6.3 Unstructured Data Metadata C-19
7. Geospatial and Tabular Data Integration C-20
7.1 Integration Tools C-20
7.2 Integration Standards C-20
7.3 Integration Workflows C-21
7.4 Data Integration Quality Assurance C-21
7.5 Data Integration Visualization, Reporting, and Analytics C-21
8. Field Data Collection Equipment C-23
8.1 Field Data Collection Equipment Training and Calibration C-23
8.1.1 GPS C-23
8.1.2 GPS Training and Calibration C-23
8.1.3 Mobile Data Collection Devices C-24
8.1.4 Mobile Data Collection Devices Training C-24
9. Post-field Data Collection and Lab Workflows C-25
9.1 Lab Data Integration and Analysis Procedures C-25

9.1.1 Chain of Custody Tracking C-25
9.1.2 Loading Laboratory EDDs to Database C-25
9.1.3 Analyte Summations C-25
9.1.4 Additional Analysis Procedures C-25
9.2 RM11E Group Data Distribution and Quality Assurance C-26
9.2.1 Tabular Data Distribution and Associated Quality Control C-26
9.2.2 Geospatial Data Distribution and Associated Quality Control C-26
9.2.3 Unstructured Data Distribution and Associated Quality Control C-26
9.3 EPA Data Submittal C-26
9.3.1 Tabular Data C-26
9.3.2 Geospatial Data C-26
10. References C-27

Tables

Table C.1-1. Components of Data Quality C-27
Table C.1-3. Data Management System Hardware and Software C-28
Table C.1-4. Historical Portland Harbor Analytical Chemistry Data Imported into Project Database C-29
Table C.1-5. Historical Data Integrated into Project Database But Not Contained Within PDI Historical Database C-30
Table C.1-6. Quality Control Procedures to be Conducted on Historical Data Integrated into Project Database C-30
Table C.1-7. Quality Control Procedures for Integrating Field Data into the Project DatabaseC-31
Table C.1-8. Required Metadata Elements C-31
Table C.1-9. Testing of ETL Operations For Tabular And Spatial Data C-33
Table C.1-10. Software and Hardware Systems Used for Managing Unstructured Data C-33
Table C.1-11. Information for Accessing the Project SharePoint Site C-33
Table C.1-12. Quality Control Procedures Run on Lab Data after Loading to the Project Enviro Data SQL Server Database C-34

Figures

Figure C.1-1. The RM11E Phase I Data Management Organizational Chart C-29
Figure C.1-2. The RM11E Phase I Data Life Cycle C-30
Figure C.1-3. GSI System Architecture for Integrated Data Management of Portland Harbor Environmental Chemistry Data C-30
Figure C.1-4. Procedures for Submitting Environmental Chemistry Data To EPA Scribe.NET ..C-32
Figure C.1-5. Simplified Entity-Relationship Diagram for Project Enviro Data SQL Server Database C-33

Figure C.1-6. Enviro Data Quality Control Data Checking Form for Loading Field and Lab Data to Database C-34
Figure C.1-7. Enviro Data Activity Log Data Entry Form C-35
Figure C.1-8. Enviro Data Documents Data Entry Form C-35
Figure C.1-9. Overview of Extract, Transform, and Load Operations for Integrating Tabular and Geospatial Data C-36
Figure C.1-10. Data Collection and Processing Workflows C-37
Figure C.1-11. Project File System Directory Structure C-38
Figure C.1-12. Project SharePoint Site Directory Structure C-39

Attachments

Attachment 1 Project Electronic Data Deliverable
Attachment 2 Scribe.NET Data Elements
Attachment 3 Primary RM11E Project Historical Geospatial Data

Abbreviations and Acronyms

AOPC	Area of Potential Concern
Cargill	Cargill, Inc.
CFR	Code of Federal Regulations
City	City of Portland
cm	centimeter
DM	Data Manager
DOF	Dalton, Olmsted & Fuglevand, Inc.
EPA	U.S. Environmental Protection Agency
FIPM	Field Investigation Project Manager
FS	feasibility study
Glacier NW	Glacier Northwest, Inc.
GIS	Geographic Information System
GPS	global positioning system
GSI	GSI Water Solutions, Inc.
HSP	Health and Safety Plan
IDW	investigation-derived waste
LWG	Lower Willamette Group
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
ORS	Oregon Revised Statute
PCB	polychlorinated biphenyl
PM	Project Manager
Portland Harbor	Portland Harbor Superfund Site
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control

QA/QC Solutions	QA/QC Solutions LLC
QC	quality control
RAL	remedial action level
RG	registered geologist
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RM	river mile
RM11E	River Mile 11 East
RM11E Group	Cargill, Inc.; CBS Corporation; City of Portland; DIL Trust; Glacier Northwest, Inc.; and PacifiCorp
RPM	Remedial Project Manager
RSS	Research Support Systems, Inc.
SAC	Sampling and Analysis Coordinator
SAP	sampling and analysis plan
SCRA	Site Characterization and Risk Assessment
SOW	statement of work
TBD	to be determined
USGS	U.S. Geological Survey
Willamette CRA	Willamette Cultural Resources Associates, LTD
Work Plan	Supplemental Remedial Investigation and Feasibility Study Work Plan

1.Introduction

This Phase I Remedial Design Data Quality Management Plan (DQMP), was prepared by GSI Water Solutions, Inc. (GSI), on behalf of Cargill, Inc. (Cargill); CBS Corporation; City of Portland (City); DIL Trust; Glacier Northwest, Inc. (Glacier); and PacifiCorp, collectively referred to as the River Mile 11 East (RM11E) Group. This DQMP is a component of Section 3.3 of the Remedial Design (RD) Statement of Work (RD SOW) for the RM11E Project Area, part of Amendment No. 1 to the Administrative Settlement Agreement and Order on Consent for Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work and Remedial Design, U.S. Environmental Protection Agency (EPA) Region 10, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. 10-2013-0087 (AOC).

1.1 Project Area Description

The Portland Harbor Superfund Site (Portland Harbor) extends from approximately river mile (RM) 1.9 to RM 11.8. of the lower Willamette River in Portland, Oregon. The RM11E Project Area (Project Area) lies between approximately RM 10.9 and RM 11.6 along the east bank of the Willamette River and includes the riverbank area from the water line to the top of the bank. The Project Area comprises several active docks associated with current operations at waterfront properties, including operations at Cargill, Glacier, and Ross Island Sand & Gravel (RIS&G). Development of the upland area adjacent to the Project Area consists of commercial and industrial facilities, roadways and railways, and an electrical substation.

1.2 Purpose and Objectives

The Phase I Remedial Design Investigation is developing a data management system (DMS) to integrate historical, harbor-wide environmental chemistry information along with new environmental chemistry data specific to the Project Area. This DQMP provides data handling procedures and processes to ensure that scientific data integrated, collected, and derived for RM11E efforts are managed in a manner that meets the data quality objectives outlined in the associated Quality Assurance Project Plan (QAPP) (Appendix B of the Phase I Remedial Design Sediment Sampling and Analysis Plan). Detailed desciptions of the sample media, locations, and analytical requirements for the Phase I sampling are presented in the Sampling and Analysis Plan (SAP) and QAPP. Tables 3-1, 3-2, 4-1, and 4-2 of the QAPP list the samples and analytical requirements.

This DQMP also ensures the data are well documented and reliably stored to support future uses and long-term preservation. The DQMP addresses requirements associated with all aspects of the project data life cycle for all project identification information, environmental sampling data, and associated geospatial data (Figure C.1-2). Planning for data management at the onset of the project will help mitigate risk throughout the data life cycle.

Specific objectives for this DQMP are as follows:

- **Define Specific Data Quality Assurance/Quality Control (QA/QC) Procedures:** The QAPP and this document present a set of quality control procedures regarding Phase I remedial design (RD) data as well as derivative data products to help ensure that project data are of

sufficient quality to meet the project objectives as defined in Section 1.3 of the SAP. The essential components of data quality addressed in this DQMP are presented in Table C.1-1.

- **Define Data Delivery and Transmission Processes:** Project data must be made accessible to internal parties and delivered to EPA promptly while meeting other components of data quality shown in Table C.1-1.
- **Provide Clear and Available Data Documentation:** Internal and external understanding of the project data requires documentation that is developed according to industry-standards and compliant with requirements in EPA guidance documents. EPA enterprise architecture principles require that "data be collected, acquired, processed, documented, stored, accessed, maintained, and retired through the use of complete, consistent, and integrated metadata" (EPA, 2005).
- **Design and Implement a Data Repository:** Achieving the above objectives requires designing and implementing a DMS for storage, analysis, and dissemination of data. The data repository is designed to achieve essential items related to data integrity. Data integrity refers to the processes and procedures in place to provide for the maintaince, accuracy, and consistency of data over the entire life cycle of the data. The essential components of data integrity are shown in Table C.1-2.

1.3 Data Management Roles and Responsibilities

The SAP details the overall roles and responsibilities related to the Phase I RD Investigation. Specifically, data management staff are responsible for the following:

1. Accurate entry of field information.
2. Accurate chain of custody forms submitted to the laboratory with the samples.
3. Field and laboratory reporting follows project-specific electronic data deliverables (EDDs) formats, and requirements.
4. Accurate entry of field and sample information into the DMS.
5. The entry of metadata—including site locations, spatial data, other pertinent information—into the DMS.
6. Providing data access to the RM11E Group and other parties via the DMS.
7. Final project data deliverables are submitted to EPA using required formats and mechanisms.

All data management staff will have a minimum of five years' experience related to their specific responsibilities. Project staff with the required level of experience will supervise any individuals without the required qualifications. Finally, the Data Manager will be versed in all project systems (e.g., EPA Scribe and Scribe.NET repository) through completion of appropriate training and coordination with the EPA data coordinator.

2. Data Management System Architecture

This section describes the overall architecture of the project DMS. EPA lists the data management platform for Portland Harbor as Scribe.NET, but allows the use of a diverse range of DMS platforms by performing parties (EPA, 2018). Ultimately, the DMS described herein will provide necessary standards to ensure transmittal between the RM11E DMS and the EPA Scribe.NET platform (EPA, 2018).

2.1 Project Software and Hardware

The DMS is composed of a set of integrated technologies listed in Table C.1-3. Metadata associated with data deliverables will detail all changes made to software and hardware used as the project progresses. The software and hardware shown in Table C.1-3 are widely used and can support multiple data uses while facilitating the transfer of project data to a wide range of technologies as required.

2.2 Data Management System Architecture

This project integrates the software listed in Table C.1-3 to produce a DMS, as shown in Figure C.1-3. This integrated approach results in secure management of RM11E data throughout its life cycle and will facilitate ready access and use of project data by scientists, engineers, geographic information systems (GIS) professionals, and data analysts. Data can be provided to project stakeholders through end-user tools including ArcGIS Online, Microsoft (MS) Power BI, and MS Access. The open-source nature of the project data model also allows for a full backup file of the MS SQL Server database to be provided, as needed, to appropriate parties.

2.3 Data Management System Security, Access, and Recovery Plan

A Windows Active Directory User ID and password will be required for GSI staff to maintain intranet/network and system security. GSI staff accessing data from remote locations will use the GSI virtual private network (VPN) login. Various levels of security, such as row-level security, can be implemented if database access is required by a broader range of approved users.

Automated backups of the project Enviro Data SQL Server database will occur weekly to nightly and as the integration of new data into the database occurs. Retention of Enviro Data SQL Server backups will be two weeks. These backups are periodically restored to ensure correct functioning of backup procedures. GSI's data redundancy systems automatically save project data stored within the GSI network to an offsite facility on a nightly basis. GSI also saves Enviro Data SQL Server backups to an offsite facility on a nightly basis.

For entities outside of GSI, the secure project SharePoint portal (Figure C.1-3) will be generally used to share project data and other information such as reports, field information, and photographs. The SharePoint portal uses the Hypertext Transfer Protocol Secure (HTTPS) to facilitate secure access by project participants. Additionally, RM11E data users can access

project data via the project ArcGIS Online website, as shown in Figure C.1-3. ArcGIS Online provides security controls for applications, networks, and facilities. ArcGIS Online is FedRAMP Tailored Low by the U.S. government (FedRAMP, 2019). Furthermore, ArcGIS Online provides a Product Security Incident Response Team to address any identified security concerns and to investigate security breaches.

All subcontractors will adhere to the data management procedures (e.g., backup, recovery, archiving, and other data management procedures) of their respective company and the terms and conditions of pertinent project contracts.

3. Tabular Data Management

This section describes the relational database management system used to store project tabular data. The majority of data associated with this project consists of tabular data related to the collection and analysis of environmental samples. Consequently, this section describes the relational database management system, and the open Enviro Data database model used for this project. Additionally, this section presents standards for database nomenclature, field data, (EDDs, and delivery of data to the Scribe.NET platform. This project also involves the integration of historical data. Consequently, this section details procedures and workflows associated with historical data integration.

3.1 Relational Database Management System

This project will use MS SQL Server 2017 as the relational database management system (RDMS) to serve as the master data repository for all analytical chemistry sample information. This sample information includes locations, results, field measurements, and associated ancillary and descriptive information documented using formal metadata. Ultimately, GSI will transfer this repository of project data to the Scribe.NET platform, following applicable standards as described below.

3.1.1 Enviro Data Database Model

The data storage structure for the Portland Harbor analytical chemistry data will follow the industry-standard data model found in the Enviro Data version 8 software package (GeoTech, 2019a). This data model represents years of continuous refinement based on the assessment of environmental data management at numerous sites, involving millions of records. The Enviro Data data model has a normalized design to reduce data redundancy while storing site characterization, physical characteristics, and operational data. The Enviro Data version 8 data model is extensive and can facilitate storing a wide variety of information including geologic units, lithology, and field observations.

The Enviro Data data model has more than 40 tables with more than 6,000 data fields. This project will use a smaller subset of related tables, as shown in Figure C.1-5. There are also many lookup tables associated with the essential data tables shown in Figure C.1-5. For example, as shown in Figure C.1-5, the ***Parameters*** table stores additional information about the coded values used in the ***Analyses*** table regarding analytes of interest. The ***Parameters*** table reduces data redundancy by using coded values to store full analyte names, as numbers, and other information about analytes or ***Parameters***.

The Enviro Data data model also contains reference tables, which are primarily used by the program to perform maintenance, analytical, or other program-specific functions. For example, there is a set of tables that can store information about regulatory limits or cleanup levels that are not directly related to any specific data tables. If desired, graphical and tabular displays of data can be developed and compared with regulatory limits within Enviro Data to quickly determine where exceedances occur. Utility tables include ***ActivityLog***, to store information about data management processes, and ***Documents***, which records information about project-related documents.

3.1.2 Database Nomenclature

This project follows database nomenclature used in the Enviro Data data model as fully described in Geotech (2019a, 2019b). Values used for Enviro Data database lookup tables will facilitate consistent nomenclature for sample locations, analytes, analytical methods, field measurements, sample matrices, and other project-specific information.

Stations will have a unique identifier, either assigned by this project for new sample locations as described in the SAP (Section 4) or following protocols used in previous efforts for historical data. Each sample will have a unique identifier following the protocols described in the SAP for new ***Sample*** locations (Section 4) or conform to historic ***Sample*** names. Enviro Data import tools as shown in Figure C.1-6 have automated techniques to check for consistent Station and Sample names as well as other data quality checks described in sections below.

All final standalone files, databases, data sets, or other documents will adhere to a project-specific naming convention for final deliverables. The file naming convention will be determined at the onset of the project.

3.1.3 Field Data Standards

Staff will record field information on waterproof field forms shown in the accompanying SAP, mobile data collection systems with electronic versions of these forms, or both. Staff will use the Environmental Research Systems Institute (ESRI) Collector and Survey 123 applications as the platform for electronic data collection. Electronic data collection will support the use of standardized picklist values, specific attribute data types, default values, and required fields to aid in automated data quality control. However, environmental conditions may preclude the use of electronic systems and warrant the need for hard copy forms to record tabular information.[1] Hard copy forms will be entered manually into the database using Enviro Data data entry forms by field staff who collected the data with associated quality control procedures described below conducted. Electronic field data can be transferred automatically to the project Enviro Data SQL Server, facilitating the use of automated quality control on the field data using existing Enviro Data tools as described below. The project may require collection of additional information beyond that requred in the field forms found in the SAP. The creation of electronic and hard copy field forms will occur as required for the project.

3.1.4 Lab Electronic Data Deliverable Standards

The Enviro Data Data Transfer Standard (GeoTech, 2019) is the foundation of the EDD format used for this project. Modifications to this base standard are made to produce the GSI EDD as specified in Attachment 1. The project EDD detailed in Attachment 1 contains specifications for location, sample, and result data to be followed by project laboratories. The project EDDs are used by the Data Manager to load data to the project SQL Server database using standard attribute names, values, and codes. Enviro Data contains tools to automate the import of the data and check for conformance to lookup table values, as shown in Figure C.1-6. However, custom import Transact-Structured Query Language (T-SQL) scripts may also be required to load project data into the SQL Server database. The final set of project lookup table or valid

[1] All coordinate locations will be recorded electronically using the project global positioning system (GPS).

value lists will be developed to be in conformance with EPA specified Scribe standards as practical.

3.1.5 Scribe.NET Standards

Submittal of prepared project data to EPA Region 10 will follow standards from Program Data Management Plan: Portland Harbor Remedial Design Investigation Portland Harbor Superfund Site. U.S. EPA Region 10 (EPA, 2018). As specified in EPA (2018), the project DM will coordinate with the EPA's Regional Scribe.NET Data Coordinator to ensure the DM has appropriate training. In particular, the project DM will be responsible for the following activities related to the appropriate submittal of project data:

- Creating EDD submittals or creating the Scribe.NET project file
- Coordinating with EPA and the Oregon Department of Environmental Quality on all data-related matters
- Participating in Portland Harbor data management coordination meetings

The overall data submittal and review process is shown in Figure C.1-4. The required data elements for meeting EPA data submittal standards are shown in Attachment 2. The submittal standards shown in Attachment 2 are based on the existing Scribe data model (EPA, 2019a). The GSI EDD will conform as much as possible to various lookup and valid values (e.g., sample methods, matrix, analytes) contained within the Scribe standard. Enviro Data has a Scribe export specification, and an initial comparison of the Enviro Data specifications to Scribe specifications indicates conformance between the two standards.

3.2 Integrating Historical Data

There has been extensive environmental sampling activities across Portland Harbor and the Project Area. The integration of historical analytical chemistry data relevant to RM11E into the Enviro Data database will be necessary for the remedial design and future evaluations of remedy performance. This section details the integration of historical data into the project Enviro Data SQL Server database.

3.2.1 Pre-remedial Design Investigation MS Access Historical Database

The pre-remedial design investigation (PDI) effort compiled a significant portion of historical data into an EQuIS database (AECOM and Geosyntec, 2019a). The data in the PDI project database was exported to an MS Access database and delivered to interested parties, including members of the RM11E Group. This MS Access database represented a normalization of various historical data sets (Table C.1-4); consequently, this database was used as the base from which to import historical data into this project's Enviro Data database.

3.2.2 Additional Historical Data Integration

The PDI historical database, however, was missing some relevant data, such as a significant portion of the sample results from the RM11E Supplemental data file (GSI, 2014). Additionally, a separate database from the PDI historical database contains the 2018 baseline sampling conducted by the PreRD Group (AECOM and Geosyntec, 2019b). Consequently, the historical data integration will also include the the missing RM11E data from previous work conducted

by the RM11E Group and the 2018 PreRD baseline data. Table C.1-5 lists the additional historical analytical chemistry data imported to the project database, which could include additional data sets as the project progresses.

3.3 Tabular Data Quality Assurance

The assurance of quality related to project tabular analytic chemistry data will occur through performing a series of quality control procedures as detailed in the project SAP, QAPP, and this document. GSI will perform quality control procedures on the historical data described above as well as new data from field data collection, laboratories, third-party validators, and other data collection events.

3.3.1 Historical Data Quality Control Procedures

Table C.1-6 lists the specific quality control procedures conducted on historical data. The Data Manager has the responsibility to ensure that all QC activities described in this section are completed. The Data Manager will be supported by the Field Investigation Project Director and the Field Investigation Project Manager, both of whom are familiar with historical data collection activities in this area. The PDI effort performed quality checks on historical data to ensure the data met data quality objectives (DQOs) (AECOM and Geosyntec, 2019a). The PDI effort excluded from the compilation data that don't meet the project-specific data quality objectives. However, the PDI effort did not remove all dredged or remediated sample locations from the PDI historical databases; therefore, this effort also flags samples of this type. End users of the project historical data will evaluate the use of historical data for project specific purposes. This could result in certain data in the database not being used for certain project activities. All uses of the project database will detail data exclusions and the reason for these exclusions.

3.3.2 Field Data Quality Control Procedures

Project field staff will scan hard copy field forms, and enter information into the project Enviro Data SQL Server database using Enviro Data data entry forms. During these data assessment and transcription activities, the field staff will track sample completion, using a custom data set. QC of incoming field data will be facilitated through Enviro Data data entry forms and batch loading tools that check for consistent sample names, standard attribute values, and other aspects of database integrity. QC review will be conducted on 100 percent of the manual data entry to identify any typographical errors. The Field Investigation Project Manager has the responsibility to ensure that all QC activities described in this section are completed. The QC procedures for loading field data to the project database are shown in Table C.1-7.

3.3.3 Lab Data Submittal Quality Control Procedures

The SAP and the QAPP detail QC checks implemented when sending field samples to the lab. The use of the project-specific EDD shown in Attachment 1 will facilitate consistent recording of environmental chemistry data in the project Enviro Data SQL Server database. The Sampling and Analysis Coordinator (SAC) is responsible for seeing that samples are sent to the laboratory as required in the SAP and QAPP and the Data Manager will see that the EDDs supplied by the laboratories meet the project-specific EDD format.

4. Geospatial Data Management

This section describes the management of geospatial data, including geodetic standards and the systems used to manage spatial data, as well as the quality measures employed to ensure geospatial data integrity and accuracy.

4.1 Geodetic Specifications and Data Quality

The geodetic specifications identified in this section are intended to standardize the positional accuracy and alignment of mapped data collection locations. These underlying standards define project data positional reference on the earth for proper mapping, visualization, analysis, calculations, and reporting.

4.1.1 Vertical Datum

A vertical datum is a surface of zero elevation to which heights at various locations on the earth are referenced (NGS, 2019). The current vertical datum for the contiguous United States is the North American Vertical Datum of 1988 (NAVD88) and will serve as the standard vertical datum for the RM11E project. The majority of data collected for the project are two-dimensional (2-D) in nature, represented by horizontal coordinates. Subsurface samples add a vertical, or three-dimensional (3-D), component to specific data. The NAVD88 vertical datum is used to map 3-D elevations. Existing elevational data sets such as topography and bathymetry also use NAVD88 for reference heights. Historical elevation data may use the National Geodetic Vertical Datum of 1929 (NGVD29). Any data referenced to NGVD29 will be converted to NAVD88 using the National Geodetic Survey's Geodetic Tool Kit, VERTCON v2.1, to compute the modeled difference in orthometric heights between the NGVD29 and NAVD88 datums. The project will use units of international feet for storage of vertical measurements and coordinates.

4.1.2 Horizontal Datum

A horizontal datum is a specified coordinate system for a collection of positions on the surface of the earth (NGS, 2019). The current horizontal datum for the United States is the North American Datum of 1983 (2011) referred to as NAD83 (2011). NAD83 (2011) will serve as the standard horizontal datum for the RM11E project. The project will use units of international feet for the storage of horizontal measurements and coordinates.

4.1.3 Coordinate System

The State Plane Oregon North coordinate system is a regional standard and the coordinate system of record for most ancillary geospatial data utilized by the RM11E project. Map and data deliverables will use the State Plane Oregon North coordinate system and the following projection parameters for the horizontal coordinate system:

- NAD_1983_2011_StatePlane_Oregon_North_FIPS_3601_Ft_Intl
- WKID: 6559 Authority: EPSG
- Projection: Lambert_Conformal_Conic

- False_Easting: 8202099.737532808
- False_Northing: 0.0
- Central_Meridian: -120.5
- Standard_Parallel_1: 44.33333333333334
- Standard_Parallel_2: 46.0
- Latitude_Of_Origin: 43.66666666666666
- Linear Unit: Foot (0.3048)
- Geographic Coordinate System: GCS_NAD_1983_2011
- Angular Unit: Degree (0.0174532925199433)
- Prime Meridian: Greenwich (0.0)
- Datum: D_NAD_1983_2011
- Spheroid: GRS_1980
- Semimajor Axis: 6378137.0
- Semiminor Axis: 6356752.314140356
- Inverse Flattening: 298.257222101
- The following projection parameters are for the vertical coordinate system:
- NAVD_1988
- WKID: 5703 Authority: EPSG
- Linear Units: Meter
- Direction: positive up
- Vertical Shift: 0.0
- Vertical Datum: North_American_Vertical_Datum_1988

4.1.4 Data Precision

Geospatial precision in this document refers to the resolution, variation, and repeatability of spatial measurements or derivations. Precision for vector data sets is of primary concern for this project, as this project will create and derive new vector data sets. Raster data used for the project will primarily consist of historical data with preexisting precision requirements. The precision requirements for new project geospatial data are as follows:

- Storing, managing, and editing of vector data will occur in ArcGIS geodatabase feature classes using ArcGIS or other appropriate editing tools. Shape files can be used to store geospatial data as approved by the DM.
- Storing of numerical data will occur using double precision with a minimum of eight decimal digits unless otherwise noted.
- Storing of vector data will occur in feature classes with only one geometry type.
- Collecting sample location information wil be conducted using a high-precision GPS unit.
- Checking will occur to ensure no loss of precision during data transformations.
- Storing, managing, and editing of raster data will occur in ArcGIS geodatabases or uncompressed tagged image file formats (TIFF) or geoTIFF files, with an associated world file.
- Scanning of hard copy maps to create a raster data set will use a minimum scanning resolution of 100 microns, or 254 dots per inch.
- Documenting of all raster and vector data following metadata standards described below to fully detail data set completeness, logical consistency, lineage, and process steps as related to data precision.

4.1.5 Data Accuracy

Geospatial data accuracy in this document refers to the degree to which information in geospatial data sets corresponds to real-world conditions or locations. Accuracy, as applies to geospatial data, can refer to both horizontal and vertical measurements. Historic data collected by GSI were mapped with sub-meter and sub-foot GPS equipment; however, this DQMP does not specify spatial accuracy requirements for historical data. . The accuracy requirements for new project geospatial data are as follows:

- Collecting of GPS data will occur using the following parameters to ensure appropriate spatial accuracy:
    - Sub-meter or sub-foot grade GPS equipment using realtime differential corrections will be employed for field mapping.
    - Data collection software will be configured to use the project's defined coordinate system for data collection accounting for transformations necessary in the communication between the GPS and the data collection software.
    - Data collection software will be configured to populate metadata values for the realtime horizontal and vertical accuracy of each position mapped in the field.
- The GPS will have independent checks of accuracy performed as follows:
    - GIS Specialist will ensure GPS and data collection software are configured correctly and test to ensure that data transmission is accurate prior to deploying equipment to the field.
    - Project field staff will check that field mapping equipment is configured appropriately, operating effectively, and receiving appropriate accuracy readings prior to data collection.

  - Field calibration will be performed by recording a point at a predetermined monument position and comparing field coordinates to known coordiantes to ensure positional accuracy.
- Integrating new and historical geospatial data will check for consistent coordinate projections and spatial extents.
- Checking of point locations will occur to ensure the project does not record duplicate points, except where intended.
- Checking to ensure polyline data sets start, finish, and connect at nodes, edges, or vertices with no self-intersections and no self-overlap.
- Checking to ensure closed polygons with a single label point and interior edges defined in a clockwise direction and exterior edges defined in a counter-clockwise direction.
- Checking to ensure that polygon features do not overlap, except where intended.
- Checking to ensure all vector data sets contain full attribution and spatial information.
- Checking to ensure that all appropriate negative values (e.g., longitude values) remain negative.
- Checking to ensure that attributes contain proper lookup values.
- Documenting all raster and vector data following metadata standards described below to fully detail data set completeness, logical consistency, lineage, and process steps as related to data precision.

4.2 Geospatial Data Model

ESRI file geodatabases will be used to store all final project spatial data unless otherwise approved by the DM. Google earth keyhole markup language files (KML), shapefiles, or other geospatial datasets might be used for interim project needs. Raster data storage will be in file geodatabases or geoTIFF files. The Enviro Data SQL Server database will serve as the final repository of environmental chemistry data for the RM11E project. The Enviro Data SQL Server database will store both historical and new baseline data. Both types of data will require export to a geospatial data format for analysis, map and figure creation, and other integrated data management activities, as described in Section 7 below.

4.2.1 Historical Spatial Data

Historical spatial data will be integrated into the project-level ESRI file geodatabase. The project Enviro Data SQL Server database will store historical spatial locations in the coordinate system described above. Historical vector data sets will be stored as point, line, and polygon feature classes and will be organized thematically in feature data sets. GSI will store historical raster data sets at the root level of file geodatabases and in an appropriate directory for geoTIFFs. GSI has cataloged pertinent historical data for the project, as shown in Attachment 3 and will continue cataloging third-party data in this manner.

As new versions of the geospatial data sets shown in Attachment 3 are made available in various repositories, such as the EPA Portland Harbor Interim Portal, staff will update project geospatial data sets in the master file geodatabase. Additionally, as new third-party project-

specific geospatial data sets (e.g., bathymetry) are published, they will be documented and maintained in the project geodatabase. The project will maintain historical metadata documents and document data transformations for all third-party data integrated into the project geodatabase. Historical data lacking metadata will have metadata elements populated as known. A raw copy of historical spatial data sets will be stored in its native format and organized according to its source as an original reference.

4.2.2 New Spatial Data Derivatives

New spatial data will be integrated into the project level ESRI file geodatabase. These data sets will be compiled in the project's standard coordinate system as needed to allow for proper mapping and analysis. Vector data sets will be stored as point, line, and polygon feature classes and will be organized thematically in feature data sets. GSI will store raster data sets at the root level of the file geodatabase or appropriate directories for geoTIFFs. New data sets will follow the naming conventions described above. Metadata for new spatial data sets and other derived data will be created and maintained as additional data transformations occur to document change control.

4.3 Geospatial Data Quality Assurance

The assurance of quality related to project geospatial data will occur through performing a series of QC procedures as detailed below. In general, GIS Specialists will perform a series of established quality control self-checks to double-check their work. Senior GIS staff or the DM and technical subject matter experts will perform additional quality checks to assure that staff develop, format, and store geospatial data to meet the project's analytical and reporting goals.

4.3.1 Quality Control Procedures

The QC procedures consist of a series of standard operating protocols for processing geospatial data collected in the field, positions generated from tabular data coordinates, and data derived from spatial analysis. Initial quality control is performed by the GIS Specialist while processing spatial data and then self-checking data integrations and deliverables. GSI will integrate all geospatial data, whether GPS field data, positions generated from tabular data coordinates, or data derived from spatial analysis into the project file geodatabase. These data sets will be reviewed for spatial integrity to address the following quality criteria:

- Features are mapped as the appropriate geometry type: point, line, or polygon
- Features are mapped the specified minimum mapping unit and required accuracy
- Feature topology has been built
- Features completely represent the mapped phenomenon and omissions are documented
- Data attribution is complete and omissions are documented
- Domain values have been applied and populated appropriately
- Metadata have been completely populated
- Data collected with GPS have GPS-specific attributes and metadata complete to identify real-time accuracy values

The DMer will review geospatial data for appropriate database integration and completeness. Technical subject-matter experts (SMEs) will review geospatial data for content and appropriate compilation of standard data conventions. For analytical results and derived data products, the SME will review spatial methodologies and the analysis process. They will check initial data inputs as necessary and cross-check with results and database for valid values.

Geospatial data collected with GPS will undergo a series of additional quality control measures. GSI will review GPS data for real-time horizontal and vertical accuracy readings auto-populated as attributes during the field data collection process. Metadata will be reviewed for additional GPS data collection-specific information that defines the collection process, purpose of survey, and appropriate use and sharing of data sets. The GIS Specialist will review GPS data with the technical subject matter expert on the following geospatial requirements:

- The positional accuracy of digitized features
- Where applicable a minimum mapping unit (MMU) will be defined to meet the project's mapping resolution requirements for RD. The need for and appropriate application of an MMU will be assessed in consultation with the design engineers as RD progresses.
- hematic attribution is complete
- Metadata are complete to Federal Geographic Data Committee standards (FGDC, 1998).

The DM will perform a secondary review of GPS data to ensure achievement of data quality metrics. The primary objective of the DM review is to confirm that database integration of GPS data is complete and reflects project objectives as described in the SAP and QAPP. Historical data might not meet all the requirements above, and will need to be evaluated on a case by case basis.

5. Unstructured Data Management

Unstructured data is information that does not have an established data model or lacks a pre-defined structure or organization. Examples of unstructured data produced through the RM11E project include project reports, memos, correspondences, maps, videos, audio files, presentations, webpages, and other documents. This section details the management and tracking of unstructured data.

5.1 Unstructured Data Standards

This section details the tools and standards GSI will use in the development of unstructured data such as reports, memos, and maps. Some unstructured project data will come from external sources. External sources of unstructured data cannot be expected to conform to the standards presented in this document.

5.1.1 Reports and Memos

Microsoft (MS) Word is used to develop project reports and memos. Figures, graphs, maps, and other associated media will be created using other software listed in Table C.1-3.

5.1.2 Presentations

Project presentations will be created using MS Powerpoint and the RM11E ArcGIS Online organizational account.

5.1.3 Maps

Digital, interactive, hard copy, and static maps will be used to depict geospatial information for the project. ArcGIS will be the primary GIS platform used for the creation of maps. GSI maintains standard mapping templates and defined cartographic elements to maintain consistency in all mapping deliverables. The RM11E mapping standards will provide the baseline template for all map production for the project. GIS Specialists will maintain the project's geospatial data and produce the mapped deliverables.

5.1.4 Email Correspondences

GSI uses MS Outlook to connect to email accounts. All project emails will be archived.

5.1.5 Other Unstructured Data

Other unstructured data will be stored using the file systems described below and backed up using the recovery model described in Section 2.3 above.

5.2 Unstructured Data Model

Unstructured project data will be stored using a combination of file, document management, and cloud storage systems, as shown in Table C.1-10. The sections below detail below the storage model and additional specifications for each system.

5.2.1 File System Storage

Figure C.1-11 shows the initial proposed directory structure for project data, including unstructured data such as reports, on the file-based system. The project file structure is designed to facilitate management of data and final delivery of project data to EPA. As project needs require, the format for the file system directory structure shown in Figure C.1-11 may change. Also, interim project needs might require the use of additional directories and directory structures.

5.2.2 SharePoint Document Management

The project SharePoint website has been set up (Table C.1-11). This site will be the repository for documents and communications as well as some data products for the RM11E project. Project participants can access the site as shown in Table C.1-11. Currently, the site is intended to be a repository for final documents; however, it may be used as a central location to temporarily post draft documents for review and data subsets or derivations from the DMS for analysis and other project-specific purposes. GSI will remove documents after they are finalized.

Additionally, we will update data products as the data change. The following guidelines apply to all users of the project SharePoint Site:

- Project members will be able to add, rename, and download files and folders to and from the site. Site administrators (Libby Smith and Alison Clements) also have the capability of deleting files.
- New files and folders posted by project members will have names that conform to the nomenclature described in Section 3.1.2. For more significant documents, it may be necessary to create a document folder to house the various pieces of each document (e.g., text, figures, tables, appendices), which should all conform to the nomenclature described in Section 3.1.2.
- Project members should update new files and folders in the Document Index (the MS Excel document located in the main folder). Document and data uploaders will fill out all fields in the Document Index. GSI will update the index every month.

The project SharePoint site maintains the directory structure shown in Figure C.1-12.

5.3 Unstructured Data Quality Assurance

This section details the quality control procedures associated with the development of unstructured data.

5.3.1 Quality Control of Reports and Memos

All reports, memos, and associated figures go through an internal review process involving SMEs, analysts, and technical editors.

5.3.2 Quality Control of Maps

GIS staff will review all visual representations of project geospatial data. GIS Specialists will produce map deliverables and perform self-checks for initial quality control. Senior GIS staff will ensure that the following aspects of map quality are performed:

- Applying map templates correctly
- Choosing colors and thematic representations
- Laying out the legend properly
- Choosing scale bars and reference scales appropriately
- Choosing font size, type, and style appropriate to the thematic features depicted
- Applying titles and subtitles consistently with project standards
- Applying appropriate reference details such as logos, north arrow, disclaimer, source credits, and other details
- Identifying the appropriate network location of the map
- Applying margins appropriately for the intended map purpose

Map presentation will also require review from technical SME to ensure quality control of the following mapping elements:

- Displaying content accurately, such as the correct display of analyte concentrations
- Mapping represents a complete portrayal of records of interest
- Mapping correctly conveys objectives and project standards

Finally, mapping deliverables will also receive an editorial review by GSI's Technical Editor, who will check for the following:

- Mapping presentation conveys thematic needs of report or project deliverable
- Mapping meets project standards for layout elements such as font, color, and logo
- Title and subtitle are consistent with report references and callouts
- The numbering of figures and pagination are consistent with report layout, table of contents, and list of figures
- Compilation of abbreviations and acronyms on the map occur in the report

5.3.3 Quality Control of Other Unstructured Data

Other unstructured data do not have formal quality control procedures applied. As appropriate and practical, other unstructured data will be reviewed and checked for quality pertinent to the use of the corresponding data.

6. Data Documentation

Documentation of spatial and tabular data will be essential to the long-term use of the project data. Additionally, EPA (2008) requires documentation of project data as per the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM). This section details the formats, specifications, and tools involved in the documentation of project data.

6.1 Tabular Data Metadata

Documentation of tabular data stored in the project Enviro Data SQL Server database occurs via several internal methods within the database as well as methods external to the database. Each table and field used in the project database has descriptive information documented in the project EDD shown in Attachment 1. Furthermore, project-specific lookup tables will be developed to document standard values and codes used for various data fields within the database. Activities conducted to load and transform data within the project database are also documented internally in the ***ActivityLog*** table. Enviro Data tools have a data entry form, as shown in Figure C.1-7, which reminds data managers to record data entry or update activity after each operation.

6.2 Geospatial Data Metadata

Some project data will be examined, delivered, and archived using geospatial data formats (e.g., file geodatabases). All project geospatial data sets will have metadata associated directly within the respective geodatabase. All metadata will be compatible with and adhere to standards set forth by the FGDC for the CSDGM (FGDC, 1998). Various tools within the ArcGIS platform will be used to validate each project metadata document for compliance with mandatory metadata elements (Table C.1-8).

6.3 Unstructured Data Metadata

Unstructured data such as reports do not always have or require associated metadata documents, as the information contained within reports, and other unstructured data is typically self-explanatory. Nonetheless, Enviro Data supports directly recording and linking documents to various samples, stations, sample plans, or other project-specific documents. The Enviro Data form used to record information about project documents or unstructured data is shown in Figure C.1-8. Additionally, GSI will link unstructured data to other structured metadata documents as appropriate using the *Citation* and *Lineage* metadata elements shown in Table C.1-8. Finally, all cloud-based and network file systems will contain a Readme or index file describing the contents of each file in the specific directory, any security concerns, and the source of the file.

7. Geospatial and Tabular Data Integration

This section describes the tools, standards, and workflows associated with the integration of project tabular and geospatial data. Project analytical chemistry data, as described above, will be stored in an Enviro Data SQL Server database. This tabular data contains geospatial components including the horizontal location of the station and vertical placement within the respective media. Integrating tabular analytical chemistry data with other geospatial data will facilitate visualization, quality control, and analysis of the data by multiple groups and specialists. The integration of tabular analytical data with other project geospatial data will involve a set of extract, transform, and load (ETL) operations to reduce the data to pertinent information while transforming and loading data to formats capable of being integrated with other data.

This section details standards for transforming tabular data into geospatial formats. Additionally, the project may require the integration of data from external sources, requiring assurance on the quality of these external data integrations. Consequently, this section details standards for integrating external data sources. Finally, workflows implemented for performing ETL and other data integration operations are detailed.

7.1 Integration Tools

GIS will serve as a primary tool for project data integration and analysis. The primary GIS platform for the project will be ArcGIS, both desktop and cloud-based systems. The ArcGIS platform supports many Open Geospatial Consortium (OGC) standards to help make data more available and capable of being integrated as described below. Additionally, the use of a SQL Server database to store tabular data will facilitate directly connecting to the project repository of tabular data via various ArcGIS tools through the development of custom query layers. These query layers will contain preset extractions of project data, facilitating consistent use and analysis of the project data. Enviro Data also facilitates the creation of standard exports of the data to formats like MS Excel, these standard exports will be used as practical to meet project needs.

7.2 Integration Standards

The project efforts need to ensure that integrated data sources are accurate, timely, and reliable. Additionally, spatiotemporal data integration requires consistent spatial and temporal extents, resolutions, coordinate projections, and data quality. Finally, all data integrations need to use data sources that are not restricted, requiring appropriate documentation of data privacy. The standards described above for tabular, geospatial, and unstructured data will aid in ensuring consistency in project data integrations. ArcGIS Online also supports several OGC specifications, including Web Feature Services, Web Map Services, and Web Map Tile Service. Consequently, the use of ArcGIS Online to deliver geospatial data will facilitate the use of the data in compliant applications outside of the ArcGIS platform.

7.3 Integration Workflows

GSI will run ETL operations to integrate tabular and geospatial data as new data are added to the project database. All ETL operations will include the unique identifier for each station location and sample in the export. Also, lab sample delivery group numbers will be transferred when ETL operations are performed. Additionally, custom query layers will be created to facilitate direct access to tabular data within GIS environments. Furthermore, GSI will integrate ancillary or external geospatial data sets into project file geodatabases and uploaded to ArcGIS Online as required. Figure C.1-9 portrays the above-described workflows.

7.4 Data Integration Quality Assurance

Quality control checks of ETL operations designed to integrate tabular analytical chemistry data containing coordinate information with other project geospatial data are detailed in Table C.1-9. The results of QC checks will be recorded in project metadata. Each ETL operation will be unit tested to ensure proper functioning of the code. The Data Manager has the responsibility to ensure that all QC activities describe in this section are completed. Senior GIS staff and technical subject matter experts will perform additional quality checks to assure that ETL operations are functioning properly.

7.5 Data Integration Visualization, Reporting, and Analytics

Other software tools listed in Table C.1-3 will facilitate consistent data integrations. For example, the use of MS Power BI for developing custom data dashboards will facilitate the consistent presentation of integrated project data. Power BI can combine mapping capabilities in ArcGIS Online with graphing and other data analytics capabilities. The combined use of project software tools such as Power BI and ArcGIS Online by RM11E project members will also aid in quality control of the project data as multiple individuals will examine the data in similar manners. This integrated approach provides numerous opportunities to identify data quality or integrity errors. Project data quality and data integrity forms will facilitate reporting of data quality or data integrity errors within ArcGIS Online.

Page left blank intentionally.

8. Field Data Collection Equipment

This section details the equipment and associated workflows related to field data collection, delivery of sample data to the lab, office data processing, and final storage of field data in the DMS. This section also details project equipment, calibration of and training on equipment, and office processing procedures. The overall process for the field, lab, and office data collection and processing workflows is shown in Figure C.1-9.

8.1 Field Data Collection Equipment Training and Calibration

8.1.1 GPS

Field data collection will be aided with use of high-accuracy GPS. Sample locations and ancilary data collection locations will be captured using an EOS Arrow Gold RTK GNSS paired with an iPad tablet. Locational positions will be recorded using the Esri ArcGIS Collector applications on the iPad while connected to the Arrow Gold through a Bluetooth pairing. The Arrow Gold is capable of obtaining 1-10 centimeter level accuracy using real-time kinematic (RTK) positioning.

Work at the RM11E will capture real-time position corrections by connecting to the Oregon Real-Time GNSS Network (ORGN) that is publicly available and maintained by the Oregon Department of Transporation (ODOT). All GPS locations mapped in the field will automatically be populated with metadata attributes to document their positional accuracy. In the event that onsite or nearby features such as buildings, bridges, ships, etc. obstruct the GPS or ORGN satellite signal, the Arrow Gold is capable of using the Wide Area Augmentation System (WAAS) to obtain sub-meter real-time positional accuracy. Additionally, the Arrow Gold is designed with SafeRTK that enable the device to maintain RTK-level accuracy for up to 20 minutes while waiting for a reconnection to the ORGN network service.

Further discussion of GPS units used for this project are described in the QAPP and shown in Table C.1-3.

8.1.2 GPS Training and Calibration

All project field staff will be trained in appropriate use of the GPS device by project staff with five years or more of GPS data collection experience. Calibration and testing of the GPS unit will occur as prior to and during the field efforts. Prior to field deployment, the GPS specialist will perform the following configuration and accuracy tests:

- Ensure that all GPS related field equipment is charged and all accessories are organized for field deployment
- Device will be turned on and paired with the tablet
- Ensure that Bluetooth connection is paired in iPad settings
- Ensure EOS application is connected to the ORGN RTK network
    - Select GSI ORGN login account and start RTK streaming

- Ensure that data collection parameters are configured in ArcGIS Collector
    - Positional Provider input is set to RTK GPS
    - RTK Location Profile is set to appropriate Datum.Verify positional accuracy is streaming in EOS and Collector applications

Once the field work begins, the field staff will repeat the equipment checks and calibration process listed above for each field event. Additionally a positional accuracy will be confirmed twice daily (mid-day and end of day) at a pre-established location or known survey monument.

8.1.3 Mobile Data Collection Devices

One system that can be utilized in the project for electronic field data collection consists of the ESRI Collector (Collector app). The Collector app has been configured to support the collection of field data following the Enviro Data standards and can be configured further as project needs require.

Additionally, the Collector app facilitates recording of images associated with each data collection point as well as information regarding that image. GSI can also link Collector to the GSI Real-time Kinematic (RTK) GPS device. Additional configurations of the Collector app can be conducted to facilitate various data collection workflows for this project.

8.1.4 Mobile Data Collection Devices Training

GSI will train all field data collection staff on the use of the project Collector app before using the applications in the field. Training will include proper recording of field data such as location identifier, sample identifiers, field measurements, and other pertinent information along with uploading data. Finally, training on mobile data collection equipment will include integrated use of all equipment, including labeling and delivering samples to the lab. GSI field staff also regularly use the Collector app and the RTK GPS device during field activities and are already generally familiar with device operation.

9. Post-field Data Collection and Lab Workflows

This section details data management activities conducted after receiving EDDs from the lab. The SAP and the QAPP detail analysis procedures for handling QA of field and lab data. This section details QC associated with loading laboratory EDDs to the project Enviro Data SQL Server database, distributing tabular and spatial data internally to project participants, and final submittal of project data to EPA.

9.1 Lab Data Integration and Analysis Procedures

9.1.1 Chain of Custody Tracking

The procedures for chain-of-custody tracking will occur as referenced in the accompanying SAP, Section 4 and Appendix B, the QAPP.

9.1.2 Loading Laboratory EDDs to Database

The use of standardized EDDs will facilitate the automated loading of laboratory results to the project Enviro Data SQL Server database. Additionally, the Enviro Data data loading form (Figure C.1-6) will perform automated checks of EDDs for conformance with valid values, data types, required fields, and other measures of data quality and integrity. GSI will document all data loading operations via the ***ActvityLog*** table, and the custom data entry form as shown in Figure C.1-7.

Other quality control checks (Table C.1-12) will occur before, during, or after loading new ***Station***, ***Sample***, and ***Analyses*** data to the project Enviro Data SQL Server database.

9.1.3 Analyte Summations

Analyte summations will follow the rules defined in Appendix A of the Portland Harbor Remedial Investigation/Feasibility Study (EPA, 2016). Additionally, analyte summations will also occur following rules found in Appendix C.3 of the PDI Evaluation Report: Portland harbor Pre-Remedial Design Investigation and baseline Sampling (AECOM and Geosyntec 2019c). Analyte summations will occur through the creation of custom T-SQL scripts. These T-SQL scripts will be unit tested for proper calculation of analyte summations. Unit tests will compare analyte summations against manual calculations for randomly selected attributes.

Additionally, GSI will compare analyte summations against analyte summations from historical efforts and will document any deviations, and examine the T-SQL code examined for correct calculation and modify accordingly. All T-SQL code will be commented and cross-referenced appropriately in accompanying metadata files.

9.1.4 Additional Analysis Procedures

Any additional analysis procedures, automated through T-SQL or another scripting language, will have unit testing procedures documented. All computer code will be commented and cross-referenced appropriately in accompanying metadata files.

9.2 RM11E Group Data Distribution and Quality Assurance

9.2.1 Tabular Data Distribution and Associated Quality Control

Tabular data from the project Enviro Data SQL Server database can be distributed via several different formats. ETL functions conducted within the GSI firewall will facilitate transformations from the SQL Server database to other formats. These ETL functions will have quality checks described in Table C.1-9 to ensure the transferred data are complete and representative of the data in the project Enviro Data SQL Server database. Depending on the size of the file, GSI will place the extracted tabular data for distribution on the project SharePoint site, the project cloud share site, or ArcGIS Online. Extermely large files might not be uploadable to the SharePoint site and will require the project cloud share site. The SharePoint file index will be used to maintain records of large files on the project cloud share site.

9.2.2 Geospatial Data Distribution and Associated Quality Control

Much of the project data, including environmental chemistry data, has associated spatial information and can be distributed via file geodatabases. Again, ETL functions will automate the transfer of data from the SQL Server database to file geodatabases. These ETL functions will have quality checks described in Table C.1-9 to ensure the transferred data are complete and representative of the data in the project Enviro Data SQL Server database. Depending on the size of the file, GSI will place the extracted geospatial data for distribution on the project SharePoint site, the project cloud share site, or ArcGIS Online.

9.2.3 Unstructured Data Distribution and Associated Quality Control

GSI will distribute unstructured data via the project SharePoint site. For data sets that are too large to include on SharePoint, the project cloud storage site will be used for distributing data.

9.3 EPA Data Submittal

This section details the procedures for submitting project tabular and geospatial data to EPA. Project tabular data will consist of analytical chemistry data; geospatial data will be derivatives products (e.g., sediment management areas) or ancillary geospatial data products derived through the effort. The overall workflows for submitting data to EPA are shown in Figure C.1-4.

9.3.1 Tabular Data

GSI will follow data submittal procedures detailed in EPA (2018). Final project data will be delivered to EPA as a Scribe formatted EDDs as shown in Attachment 2. The project Data Manager will inform the EPA RPM and the EPA Scribe.NET Data Coordinator of the submission and provide the Scribe project number.

9.3.2 Geospatial Data

GSI will follow EPA guidance for submitting project GIS deliverables (EPA 2019b) to EPA. As described above, project metadata, naming conventions, file formats, directory structures, and quality control checks will conform to EPA-specified guidance (EPA 2019b).

10. References

AECOM and Geosyntec. 2019a. Appendix C.2 Historical Database Description. PDI Evaluation Report: Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. June 17, 2019.

AECOM and Geosyntec. 2019b. Appendix C.1 PDI Database Description. PDI Evaluation Report: Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. June 17, 2019.

AECOM and Geosyntec. 2019c. Appendix C.3 Data Summing Rules. PDI Evaluation Report: Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. June 17, 2019.

EPA. 2008. National Geospatial Data Policy. August 24. U.S. Environmental Protection Agency website, https://www.epa.gov/geospatial/epa-national-geospatial-data-policy (Accessed September 2019).

EPA. 2005. National Geospatial Data Policy Procedure for Geospatial Metadata Management. October, 2005. EPA Classification No.: CIO 2131-P-01-0. EPA Chief Information Office CIO Transmittal No.: 08-004.

EPA. 2016. Portland Harbor RI/FS, Final Feasability Study, Portland Oregon. EPA Region 10. Seattle, Washington. June, 2016.

EPA. 2018. Program Data Management Plan: Portland Harbor Remedial Design Investigation Portland Harbor Superfund Site. U.S. EPA Region 10. August, 2018.

EPA. 2019a. Scribe Support and Development website. https://response.epa.gov/site/site_profile.aspx?site_id=ScribeGIS (Accessed September 2019).

EPA. 2019b. U.S. EPA Region 2 Geographic Information Systems (GIS) Data Deliverable Guidance. U.S. Environmental Protection Agency website, https://www.epa.gov/geospatial/epa-region-2-gis-deliverables-guidance (Accessed September 2019).

FGDC. 1998. FGDC-STD-001-1998. Content standard for digital geospatial metadata (revised June 1998). Federal Geographic Data Committee. Washington, D.C.

FedRAMP. 2019. Pursuing a FedRAMP Tailored Authorization. FedRAMP website, https://www.fedramp.gov/pursuing-a-fedramp-tailored-authorization/ (Accessed September 2019).

GeoTech. 2019a. Data Transfer Standard. Enviro Data Version 8. Geotech Computer Systems, Inc. Centennial, CO. October, 2019.

GeoTech. 2019b. Enviro Data Relational Management of Site Environmental Data: Version 8 User Documentation. Geotech Computer Systems, Inc. Centennial, CO. October, 2019.

GSI. 2014. Appendix K Data File: Final Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland Oregon. Prepared by GSI Water Solutions. http://ph-public-data.com/file/download/AppendixK_RM10_to_12_Datafile.xlsx (Accessed September 2019).

National Geodetic Survey (NGS), National Oceanic and Atmospheric Administration (NOAA). 2019. Datums and Reference Frames. https://www.ngs.noaa.gov/datums/index.shtml (Accessed September 2019).

Tables

Page left blank intentionally.

Table C.1-1. Components of Data Quality

Component	Description	Examples
Completeness	An indication of the comprehensiveness of a respective data set, particularly in context of the intended use of the data	Missing samples An impartial analysis of analytes
Uniqueness	A discrete measure identifying any duplication in the respective data set	Duplicate stations Duplicate records for analytes
Timeliness	A measure indicating whether the respective data set is up-to-date and timely, given the intended purpose	Date of samples Date of analysis
Validity	A set of measures to determine the validity of the data for the intended purpose	Data Type Data Range Incorrect Values
Accuracy	A measure detailing the conformance of the respective data to the to the actual site conditions.	Global Positioning System (GPS) data Lab analyses
Consistency	A set of measures describing the usability of the respective data set	Field blanks that are not contaminated

Table C.1-2. Components of Data Integrity

Component	Description	Sub-Components
Physical Integrity	Physical integrity handles collecting and maintaining the data correctly as well as disseminating the correct data to appropriate audiences.	***Traceable***: The origin of the data in terms of who collected or observed the data should be precise along with clear descriptions of the data. ***Understandable***: The provided data should be capable of being understood with lineage and the structure of the data documented. ***Accessible***: The data upon delivery to the system should be accessible and ready to use for the intended purpose. ***Safeguarded***: The data upon delivery to the system should be in a format that will have the highest utility for future use, be stored in multiple locations, and have appropriate security.
Logical Integrity	Logical integrity deals with the correctness of the data. It includes concepts of relational database integrity and the integrity of the data as it relates to real-world conditions or other measurements.	***Entity Integrity***: A component of relational database design used to ensure unique records (i.e., no two rows can be the same) within a table by defining a primary key with a unique identifier. ***Referential Integrity***: A component of relational database design concerned with relationships between tables to ensure that related tables do not have conditions where a foreign key value has no matching primary key values (i.e., orphaned records). This type of integrity can help ensure modeled relationships are consistent with real-world conditions (e.g., each sample location has analytical results) and prevent accidental deletion of data. ***Domain Integrity***: A component of relational database design concerned with valid values for a particular attribute. Valid values must conform to the specified data type, applicable constraints, and value lists. ***Business Integrity***: A component of relational database design concerned with applying specific business or scientific rules to the data. This is typically achieved by having certain operations in the database "trigger" operations or changes to the data. For example, loading new data to a database could trigger a procedure to run extract, transform, and load (ETL) operations for updating file geodatabases.

Table C.1-3. Data Management System Hardware and Software

Software/Hardware	Description	Project Purpose
Environmental System Research Institute ArcGIS Advanced with Spatial Analyst (10.6.1)	GIS desktop software	Quality control procedures, mapping geospatial analysis, and data management.
ArcGIS Online	Cloud-based GIS	Field data collection, quality control procedures, mapping, data dissemination
Global Positioning System (GPS)	• Geo 7X with Zephyr Model 2 GNSS antenna. • RTK GPS Unit (TBD)	Collect spatial information for project sampling locations
ESRI Collector	Mobile-based application for storing field data	This application will be used to record field photos and associated information.
iPad	Mobile collection device	Houses the ESRI Collector
Enviro Data Version 8 A 1.73	Environmental data management system	This application facilitates the use of an industry-standard data model while providing automated quality control and analysis procedures for the project.
Microsoft SQL Server 2017	Enterprise relational database management system	This software facilitates the storage of large amounts of data for the project.
Microsoft Power BI	Business information and analytics software	This software facilitates data analysis and development of project data dashboards.
SharePoint Server	Cloud-based document sharing	This cloud-based software facilitates the sharing of project documents and data.
Microsoft Access	Relational database software	This database software facilitates the sharing of subsets of the project data.
Microsoft Office suite of products	Spreadsheet and word processing software	Develop project reports, memos, graphs, and figures

Table C.1-4. Historical Portland Harbor Analytical Chemistry Data Imported into Project Database

Historical Database	Database Source
Remedial Investigation Database	http://ph-public-data.com/file/download/2016-02-08%20Portland%20Harbor%20RI%20Appendix%20A3_RI-Dataset_RA-SummedParams.zip
Feasibility Study Database	http://ph-public-data.com/file/download/LWGFSdbwEECA_GASCOandArkema_20141117_v2.zip
Final Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland, Oregon	http://ph-public-data.com/file/download/AppendixK_RM10_to_12_Datafile.xlsx
The Nature and Sources of PAH in Sediments in the Vicinity of the Former ExxonMobil Terminal 2014 Investigation	http://ph-public-data.com/file/download/Ref%203%20NewFields%20Microsoft%20Access%20database.mdb
Kleinfelder Sediment Sampling Data Report. Portland Harbor, June 2015	Unknown
Geosyntec Sediment Sampling Data Report, Swan Island Lagoon, August 2016	Unknown
Field and Data Report Downtown Portland Sediment Characterization, Willamette River, Portland, Oregon (Phase 1), 2009	http://ph-public-data.com/file/download/WLLAS_studies.xlsx
Field and Data Report, Downtown Portland Sediment Characterization (Phase II), 2010	http://ph-public-data.com/file/download/WLLAS_studies.xlsx
Final Field and Data Report, Upriver Sediment Characterization (URSC), Lower Willamette River, 2018	http://ph-public-data.com/document/GSI_2018/

Table C.1-5. Historical Data Integrated into Project Database But Not Contained Within PDI Historical Database

Historical Database	Database Source	Data Integration Notes
Final Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland, Oregon	http://ph-public-data.com/file/download/AppendixK_RM10_to_12_Datafile.xlsx	Samples RM11E-G080 to RM11E-G089 from the EPA Interim Portal were integrated into the project Enviro Data SQL Server database.
PDI Data Export	Pre-RD group sampling data, not currently public	Data were normalized and integrated into the project Enviro Data SQL Server database.

Note
PDI = Pre-remedial Design Investigation

Table C.1-6. Quality Control Procedures to be Conducted on Historical Data Integrated into Project Database

Quality Control Procedure	Description
Data Location Checks	Compare spatial locations of data found in the PDI database of historical locations to locations listed on the EPA Interim Portal
Data Results Checks	Compare result data as found in the PDI database of historical results to results found on the EPA Interim Portal for the RM11E project area
Data Valid Value and Lookup Checks	Ensure consistent formatting of coded values in the historical database compared to lookup values in Enviro Data and Scribe data model
Duplicate Sample Checks	Check to ensure that there are no duplicate samples.
Duplicate Result Checks	Check to ensure that there are no duplicate results.
Data Validation Checks	Check to ensure that all integrated data are validated and all validated and unvalidated data are coded appropriately.
Analyte Summation Checks	Check to ensure that all summed analytical results are flagged as not validated.

Notes
EPA = U.S. Environmental Protection Agency
PDI = Pre-remedial Design Investigation
RM11E = River Mile 11 E

Table C.1-7. Quality Control Procedures for Integrating Field Data into the Project Database

Quality Control Procedure	Method
Spatial Location Checks	Visual examination of field recorded spatial locations
Station Name Checks	Implementation of custom queries and the Enviro Data "Import Wizard" to ***Stations*** have consistent names
Sample Name Checks	Implementation of custom queries and Enviro Data "Import Wizard" to ***Samples*** have consistent names
Field Image Checks	Implementation of custom queries to check for appropriate images for ***Samples***.
Valid Value and Lookup Table Checks	Implementation of domains in electronic field data collection applications, custom queries, and Enviro Data "Import Wizard to check for valid values
Check to ensure that required fields with blank values have appropriate default values	Implementation of custom queries and the Enviro Data "Import Wizard"

Table C.1-8. Required Metadata Elements

FGDC CSDGM Element	Description (FGDC, 1998)
Citation	The recommended reference to be used for the data set
Abstract	A brief narrative summary of the data set
Purpose	A summary describing the intentions for which the data set was developed
Time Period of Content and Currentness Reference	The period(s) for which the data set corresponds to the specified currentness reference
Status	The state of and maintenance information for the data set
Spatial Domain	The geographic areal domain of the data set as a description and using geographic coordinates
Keywords (Theme, Place, Stratum, Temporal)	Words or phrases summarizing a pertinent aspect of the data set. Theme keywords represent the subject covered by the data set (e.g., analytical chemistry). Place keywords describe geographic locations characterized by the data set. Stratum keywords describe layered, vertical locations characterized by the data set. Temporal keywords describe time period(s) characterized by the data set.
Access Constraints	Restrictions and legal prerequisites for accessing the data set. Constraints should include any access constraints

FGDC CSDGM Element	Description (FGDC, 1998)
	applied to assure the protection of privacy or intellectual property and any unusual restrictions or limitations on obtaining the data set.
Use Constraints	Restrictions for using the data set. Restrictions include constraints applied to assure the protection of privacy or intellectual property, and any unusual restrictions or limitations on using the data set.
Point of Contact	Contact information for an individual or organization that is knowledgeable about the data set
Data Set Credit	Recognition of those who contributed to the data set
Security Information	Handling restrictions imposed on the data set because of national security, privacy, or other concerns
Cross Reference	Information about other, related data sets that are likely to be of interest
Quantitative Attribute Accuracy Assessment	An assessment of the accuracy of the identification of entities and the assignment of attribute values in the data set
Logical Consistency Report	A description of the degree of exactness of relationships in the data set. The report shall detail the tests performed and the results of the tests.
Completeness Report	Information about omissions, selection criteria, generalization, definitions used, and other rules used to derive the data set.
Horizontal Positional Accuracy Assessment	An assessment of the accuracy of the horizontal positions of the spatial objects
Vertical Positional Accuracy Assessment	An assessment of the accuracy of the vertical positions of the spatial objects
Lineage	Information about the events, parameters, and source data that constructed the data set as well as information about the responsible parties
Spatial Data Organization Information	The mechanism used to represent spatial information in the data set
Spatial Reference Information	The description of the reference for, and the means to encode, coordinates in the data set
Entity and Attribute Information	Details about the information content of the data set, including the entities types, their attributes, and the domains from which attribute values may be assigned
Distribution Information	Information about the distributor of and options for obtaining the data set

Note
FGDC CSDGM = Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata.

Table C.1-9. Testing of ETL Operations For Tabular And Spatial Data

Type of Test	Description
Source To Target Testing	This testing is conducted to ensure that the transformed data values conform to expected data values.
Data Completeness Testing	This testing is conducted to ensure that a complete set of data is extracted, transformed, and loaded from the project SQL Server database to other database formats (e.g., file geodatabases).
Data Type Testing	This testing is conducted to ensure that data type, lengths, and indexes or constraints are transformed correctly.
Data Accuracy Testing	This testing is conducted to ensure that data are accurately transformed.
Incremental ETL Testing	This testing is conducted as new data are loaded to the system and ETL operations run. This testing verifies that inserts and updates are being processed correctly.

Table C.1-10. Software and Hardware Systems Used for Managing Unstructured Data

Software	Description	Purpose
NTFS	New Technology File System developed by Microsoft as the default file system	Store project data not stored in the SQL Server or project file geodatabases
SharePoint	A secure, cloud-based document sharing system	Manage and share project documents
GSI Document Share	A secure, cloud-based document and data-sharing system	Share larger files that cannot be stored on the SharePoint site

Table C.1-11. Information for Accessing the Project SharePoint Site

SharePoint Web Address	http://rm11.gsiws.com	
User name	backslash + your first initial + your last name	Example: \AClements
Password	your last name + your first initial (first initial is lowercase)	Example: Clementsa

Table C.1-12. Quality Control Procedures Run on Lab Data after Loading to the Project Enviro Data SQL Server Database

Quality Control Procedure	Description
Data Valid Value and Lookup Checks	Ensure consistent formatting of coded values in the historical database compared with lookup values in Enviro Data and Scribe data model
Duplicate Sample Checks	Check to ensure that there are no duplicate samples.
Duplicate Result Checks	Check to ensure that there are no duplicate results.
Data Validation Checks	Check to ensure that all integrated data are validated and all validated and unvalidated data are coded appropriately.
Analyte Summation Checks	Check to ensure that all summed analytical results are flagged as not validated.

Page left blank intentionally.

Figures

Page left blank intentionally.

Figure C.1-1. The RM11E Phase I Data Management Organizational Chart

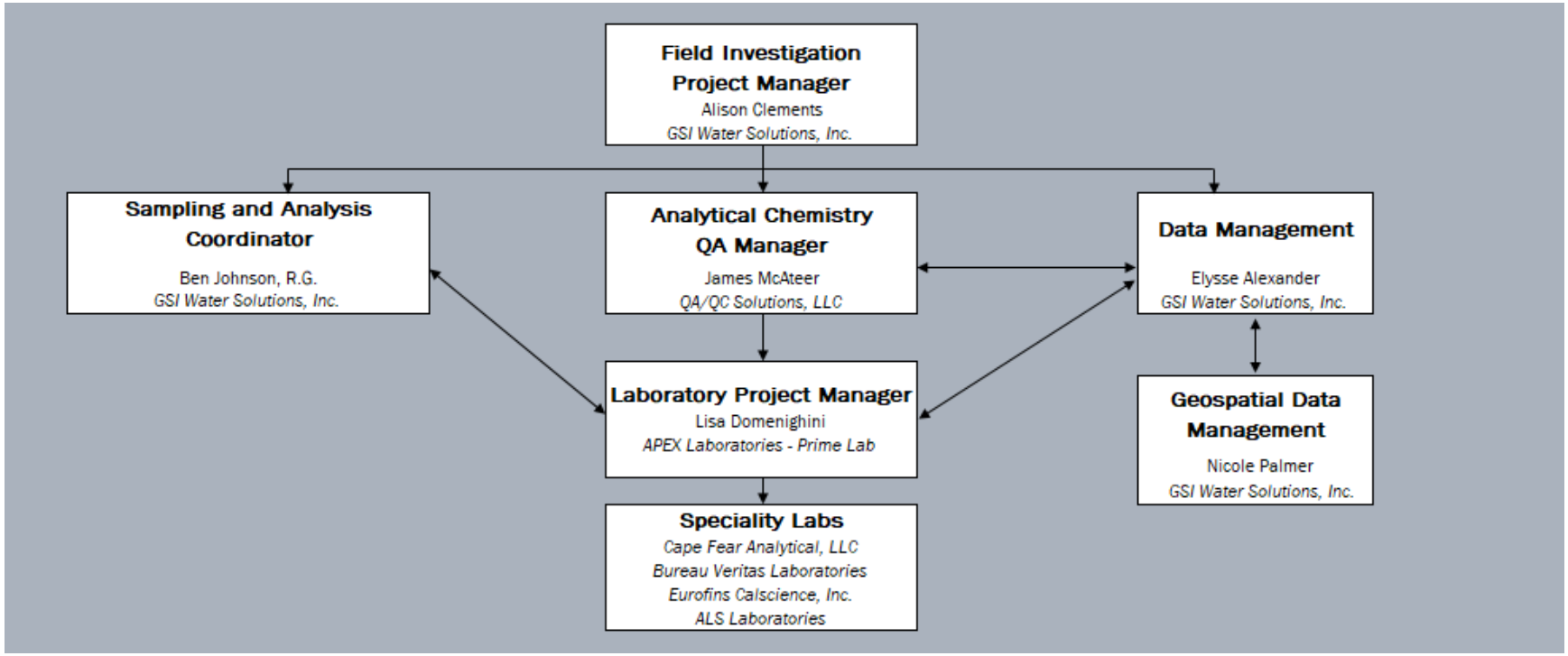


Figure C.1-2. The RM11E Phase I Data Life Cycle

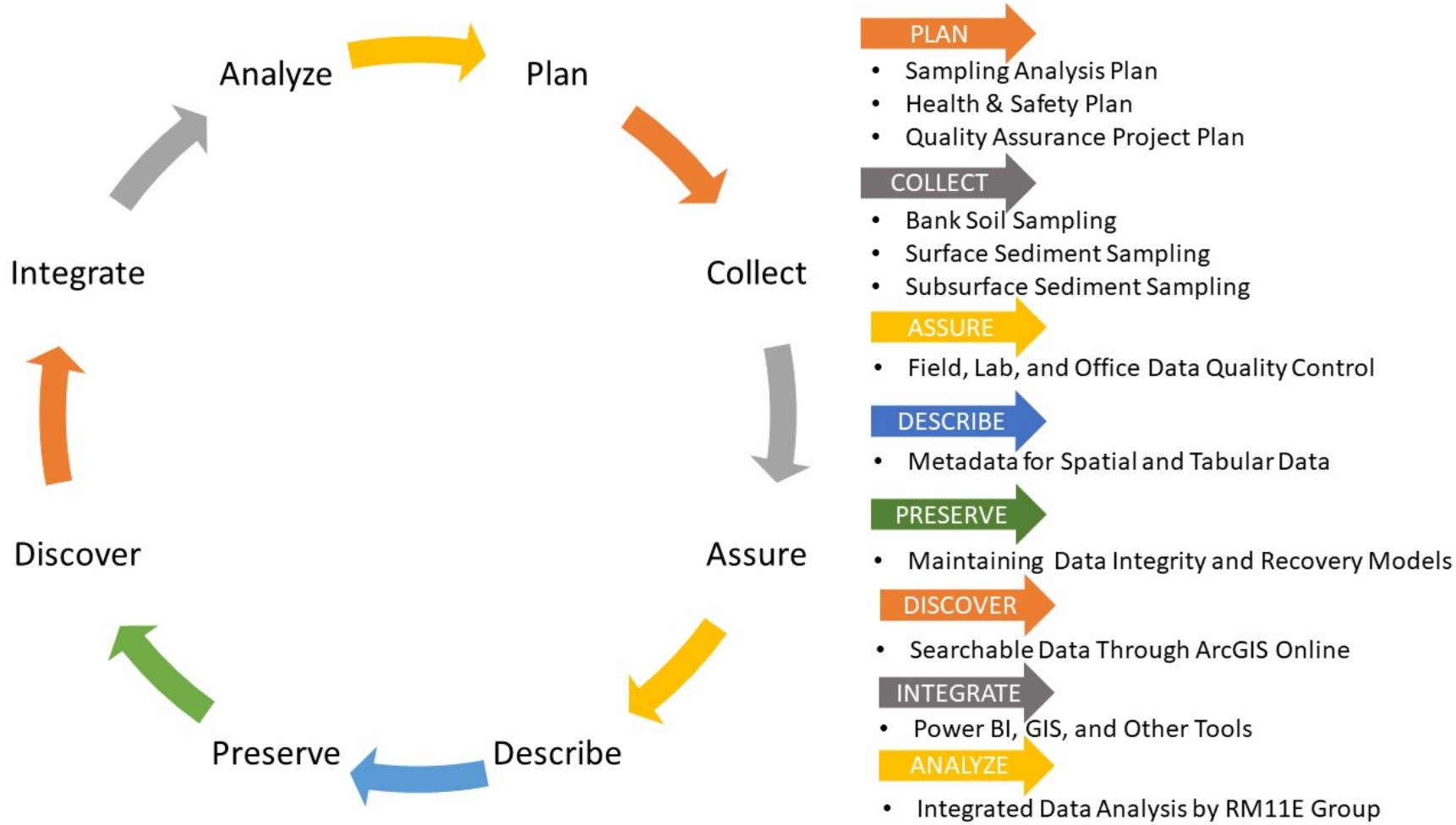


Figure C.1-3. GSI System Architecture for Integrated Data Management of Portland Harbor Environmental Chemistry Data

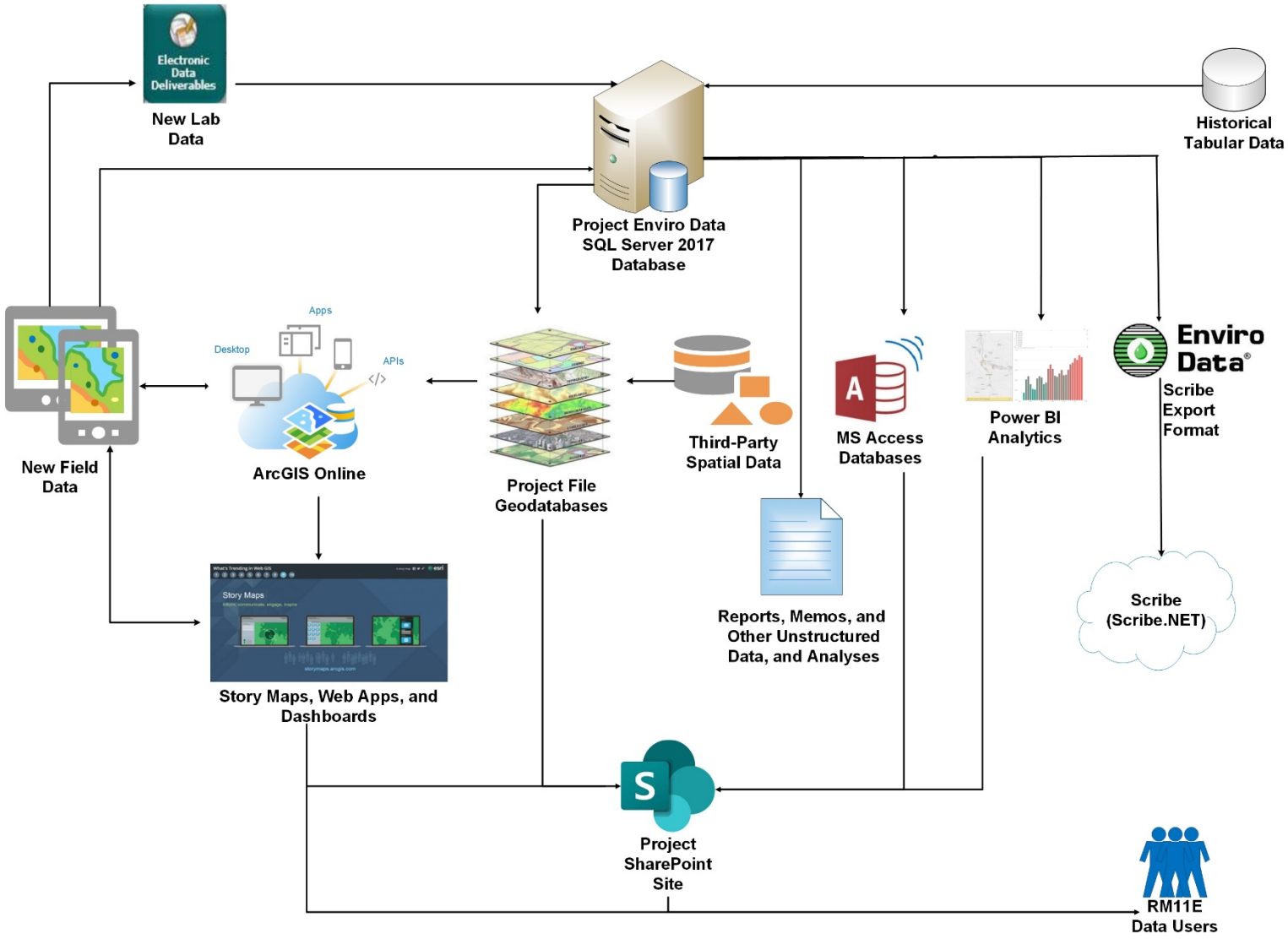

Electronic Data Deliverables
New Lab Data
Historical Tabular Data
Project Enviro Data SQL Server 2017 Database
New Field Data
Apps
Desktop
APIs
ArcGIS Online
Project File Geodatabases
Third-Party Spatial Data
MS Access Databases
Power BI Analytics
Enviro Data®
Scribe Export Format
Reports, Memos, and Other Unstructured Data, and Analyses
Scribe (Scribe.NET)
Story Maps
Story Maps, Web Apps, and Dashboards
Project SharePoint Site
RM11E Data Users

Figure C.1-4. Procedures for Submitting Environmental Chemistry Data To EPA Scribe.NET

Source: Program Data Management Plan: Portland Harbor Remedial Design Investigation Portland Harbor Superfund Site. U.S. EPA Region 10. August, 2018.

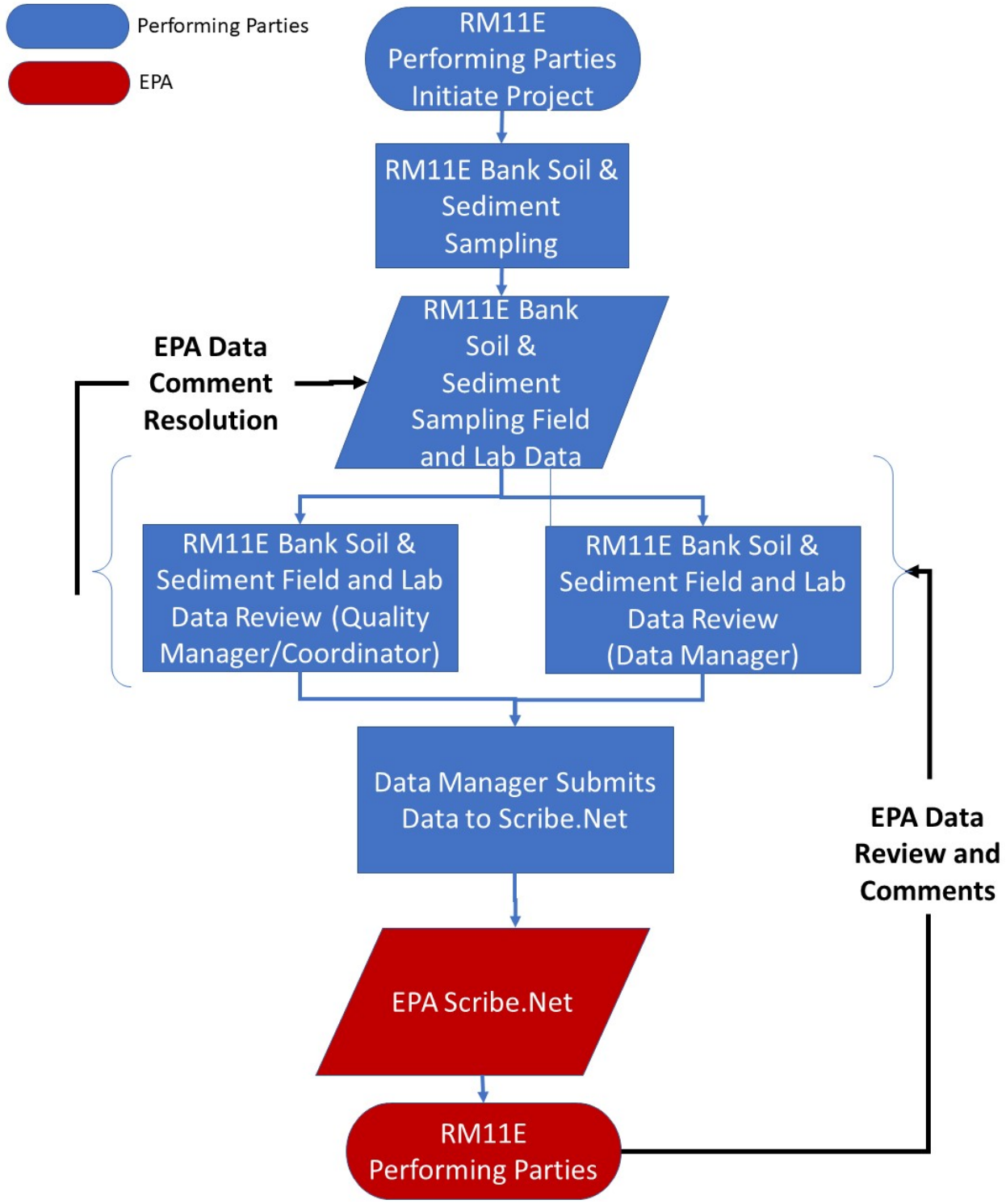


Figure C.1-5. Simplified Entity-Relationship Diagram for Project Enviro Data SQL Server Database

Source: Data Transfer Standard. Enviro Data Version 8. Geotech Computer Systems, Inc. Centennial, CO. GeoTech. October, 2019.

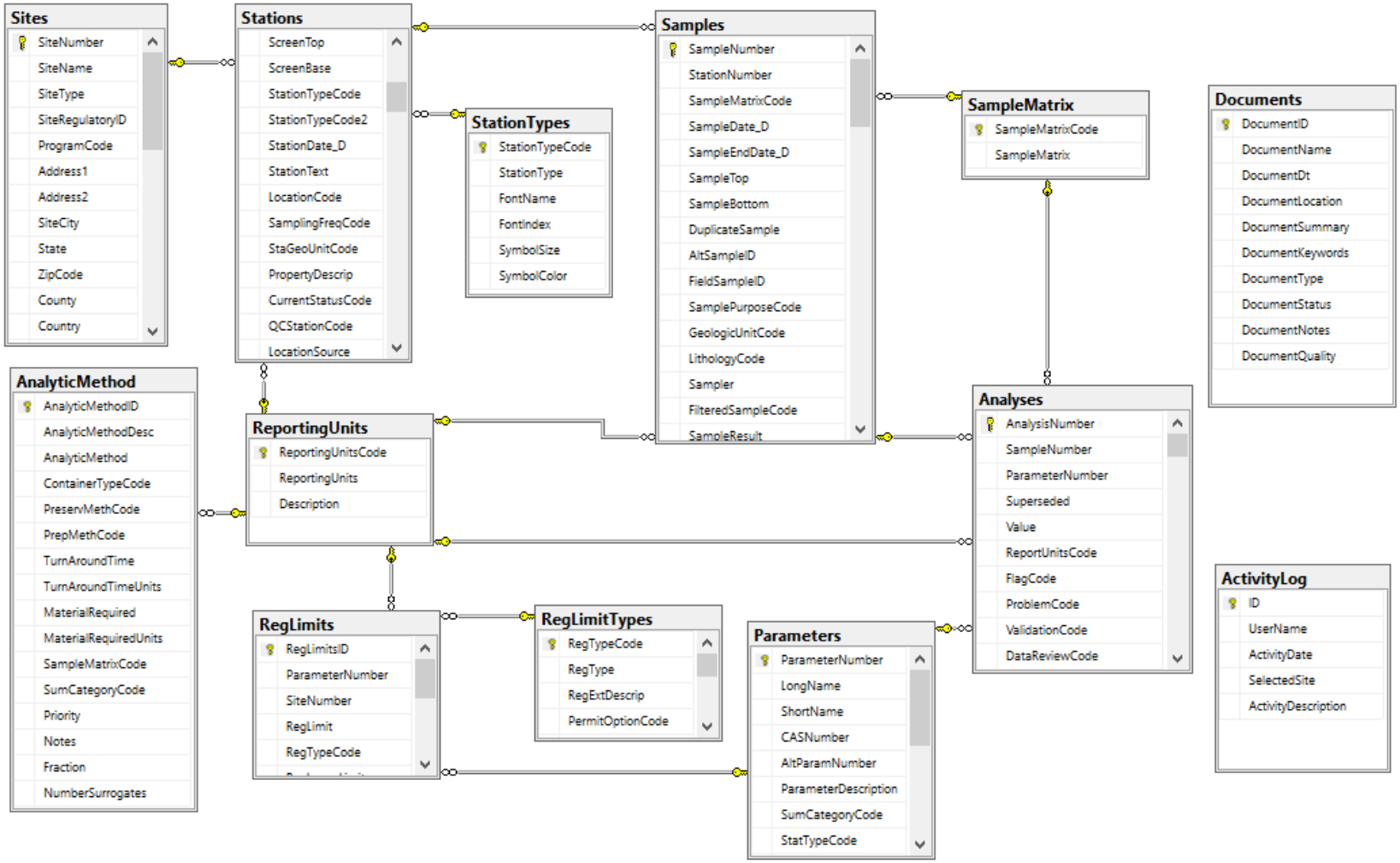


Figure C.1-6. Enviro Data Quality Control Data Checking Form for Loading Field and Lab Data to Database

Source: Data Transfer Standard. Enviro Data Version 8. Geotech Computer Systems, Inc. Centennial, CO. GeoTech. October, 2019

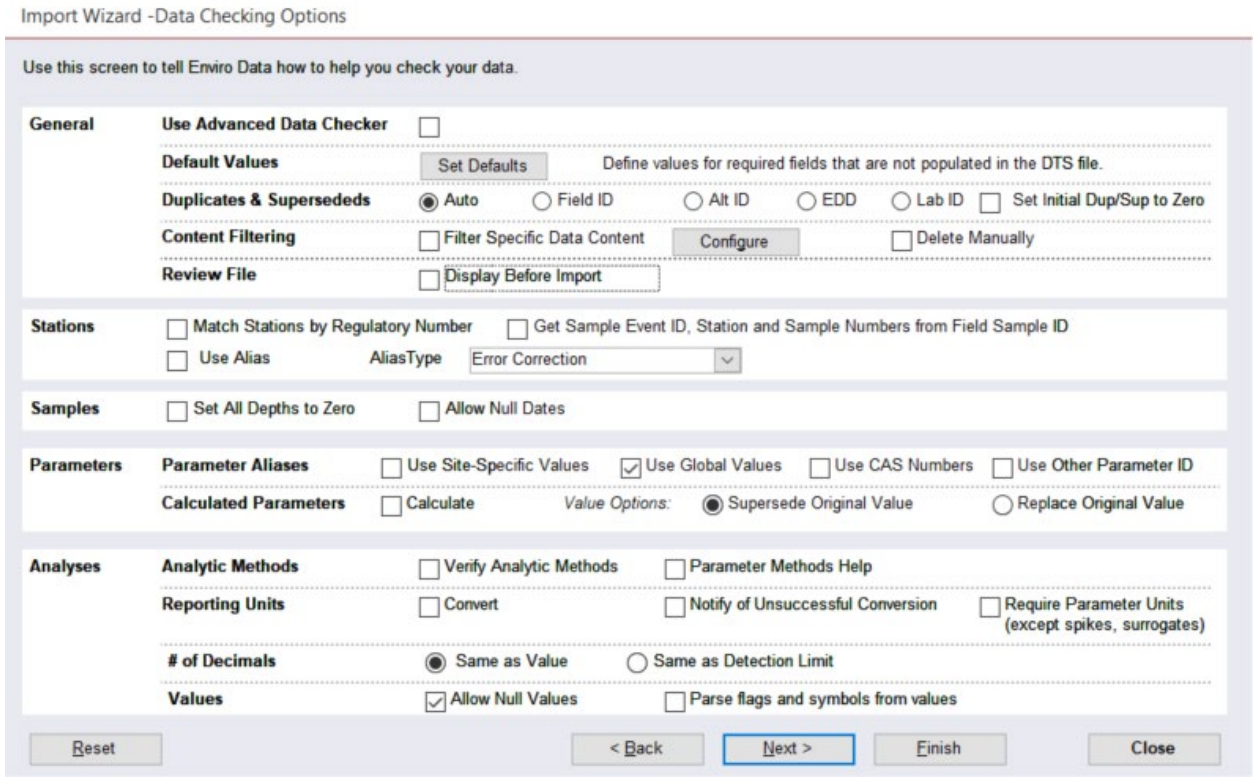


Figure C.1-7. Enviro Data Activity Log Data Entry Form

Source: Data Transfer Standard. Enviro Data Version 8. Geotech Computer Systems, Inc. Centennial, CO. GeoTech. October, 2019

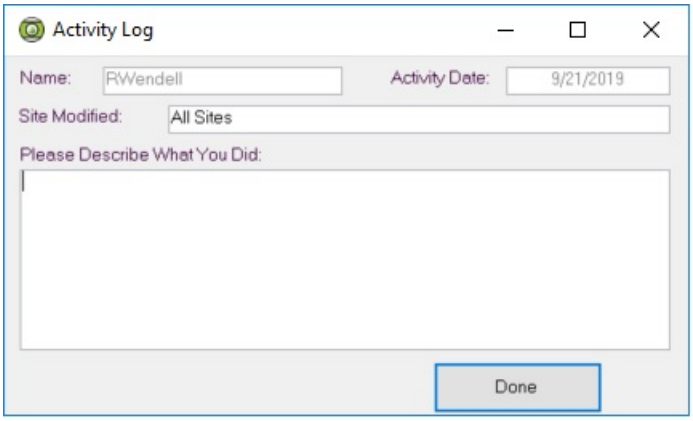


Figure C.1-8. Enviro Data Documents Data Entry Form

Source: Data Transfer Standard. Enviro Data Version 8. Geotech Computer Systems, Inc. Centennial, CO. GeoTech. October, 2019

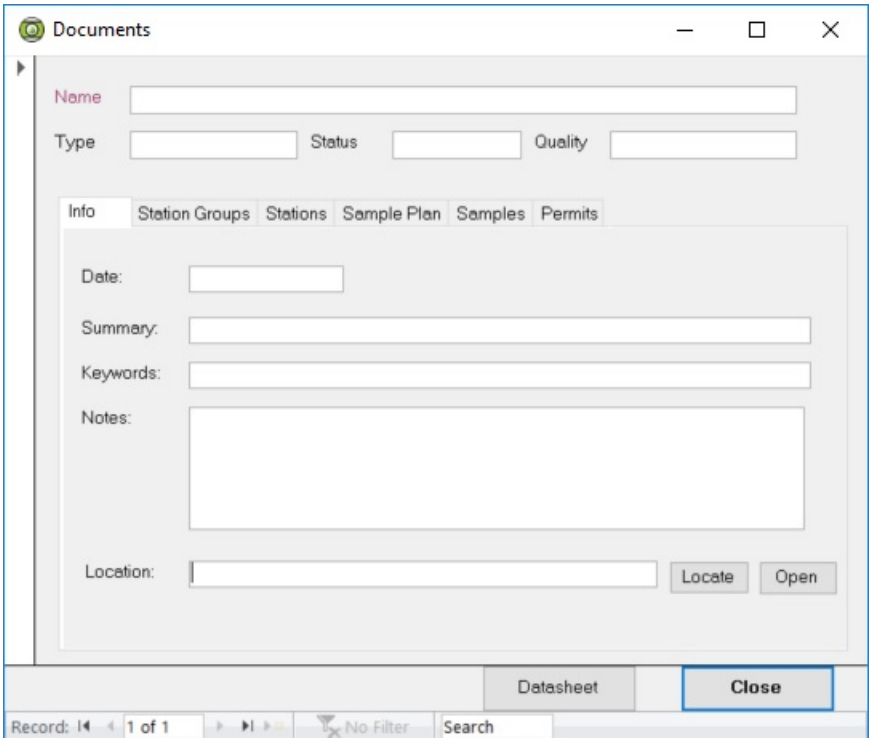


Figure C.1-9. Overview of Extract, Transform, and Load Operations for Integrating Tabular and Geospatial Data

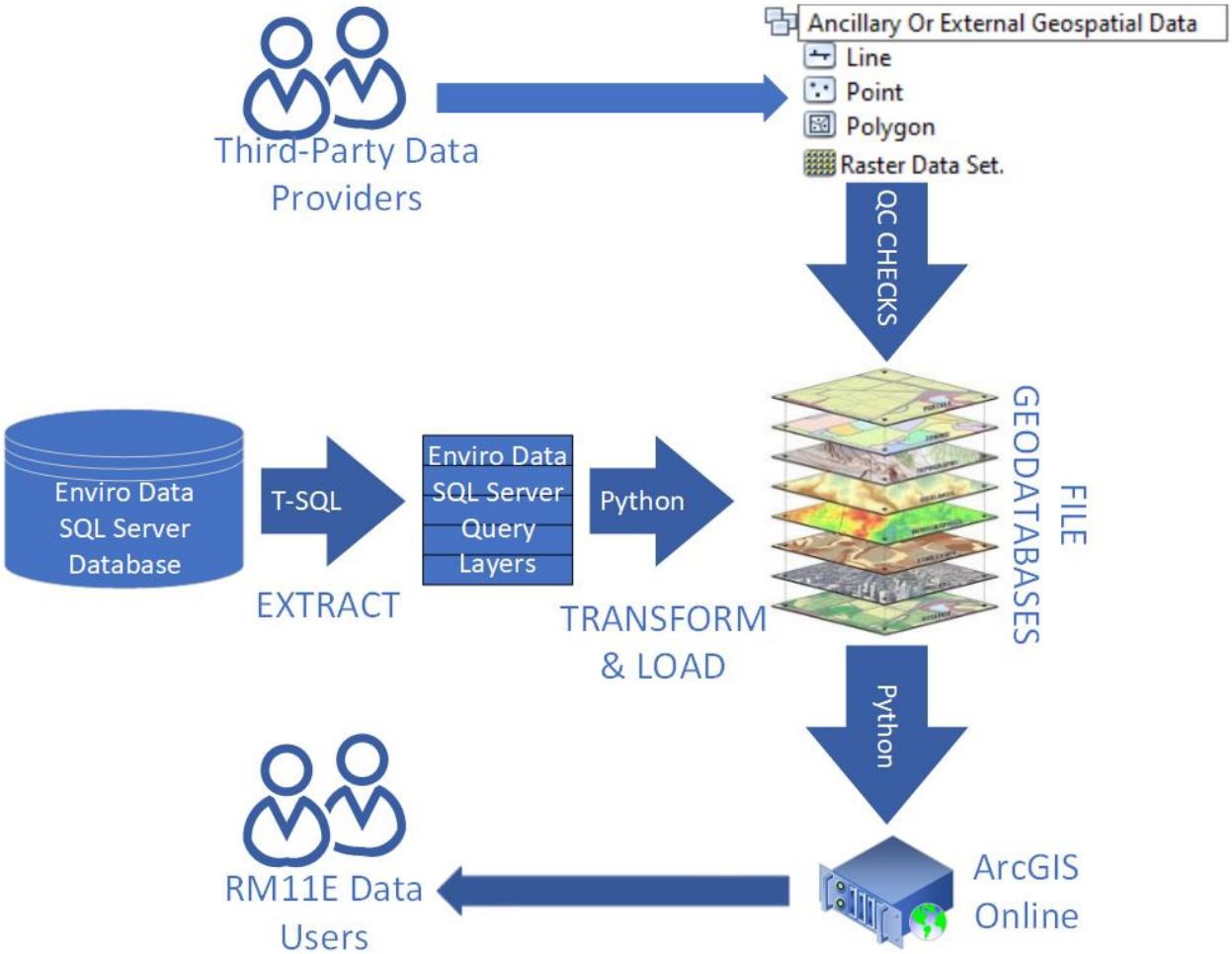


Figure C.1-10. Data Collection and Processing Workflows

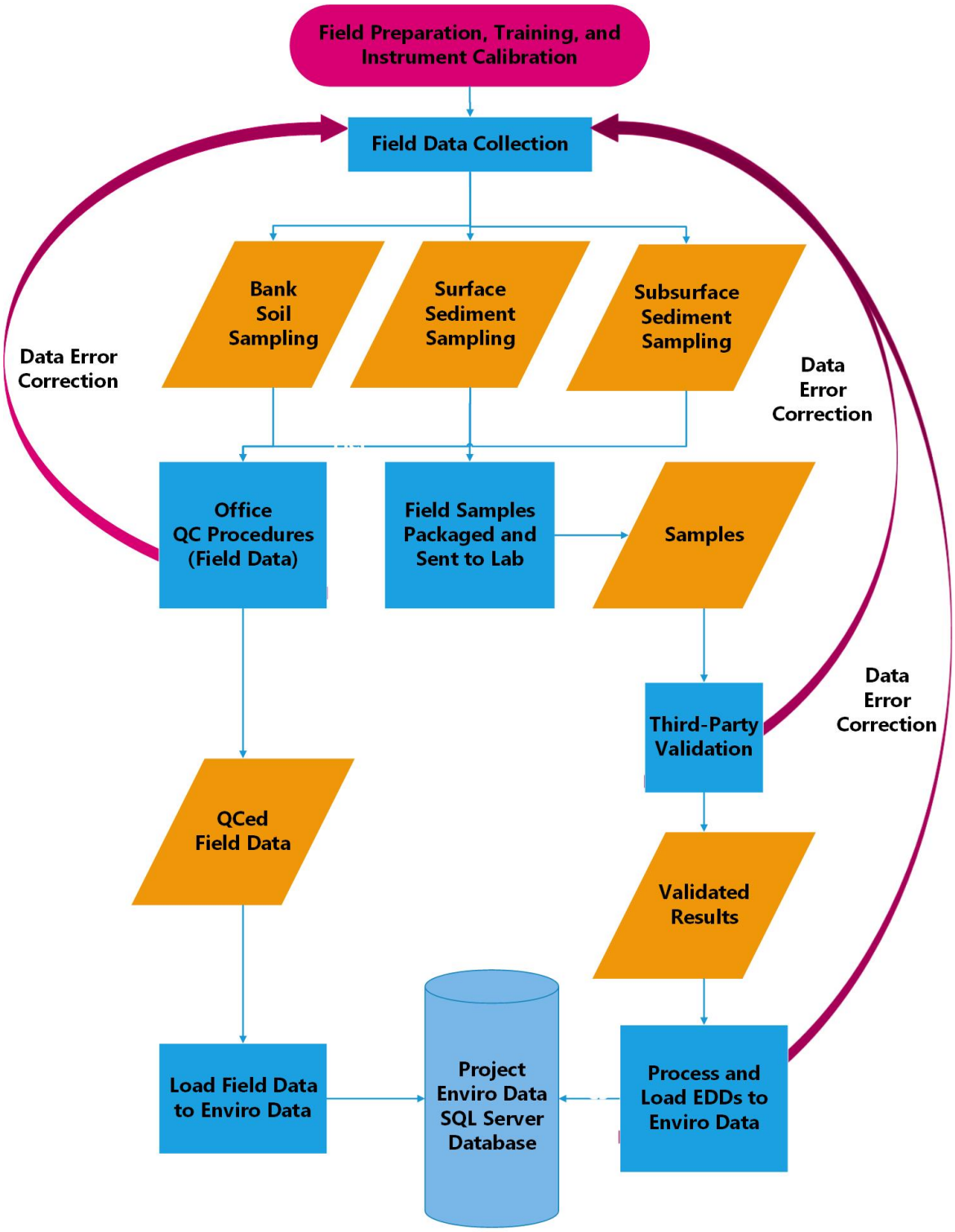


Figure C.1-11. Project File System Directory Structure

- **AGOL** *(ArcGIS Online Directory to Store Data Uploaded to and Downloaded From ArcGIS Online)*
  - **To** *(Data Uploaded to ArcGIS Online)*
  - **From** *(Data Downloaded ArcGIS Online)*
- **Databases** *(Project MS Access and Other File Based Tabular Databases)*
- **Deliverable (Project deliverables or submittals to EPA)**
- **Georeferenced (***Project Georeferenced Data Such as Historic Maps or Images***)**
- **GoogelEarth** *(Google Earth Files Representing Project Data)*
- **GPS** *(Project GPS Data)*
- **Metadata** *(Project-Related Tabular and Geospatial Metadata)*
- **Modeling** *(Results of Any Project Modeling Efforts)*
- **Source** *(Source Data for the Project From External Sources, Laboratories, or Field Data Collection)*
  - **EntityName_YYYYMMDD** *(Source Data Will be Stored in Directories Named with the Source of the Data and the Date the Data Were Received)*
- **Spatial** *(Project Spatial Databases and File Geodatabases)*
- **Tabular** *(Project Tabular Data Files Such as MS Excel Spreadsheets)*

Figure C.1-12. Project SharePoint Site Directory Structure

- **Administrative Documents (AOC, notice letters, etc.)**
  - Access Agreements
  - AOC/SOW
  - Community Relations Plan
  - Contacts
  - Financial
  - Insurance
  - Permits
- **Reference Documents and Data**
  - GIS and Data
  - RM11E Documents
    - Albina E&M (DIL Trust)
    - Cargill
    - CBS
    - City
    - Glacier
    - PacifiCorp
    - LWG
    - Other PRPs
    - Stan Herman
  - PHSS Documents
    - LWG
    - EPA
    - Department of Environmental Quality (DEQ)
    - Pre-RD Group
  - Policy and Guidance Documents
- **RM11E Group-produced Technical Documents and Data**
  - Data
  - Hydro survey data
  - Technical documents - Final
  - Technical documents: Working drafts for Internal Review (will be deleted after draft is finalized)
- **Communications**
  - EPA
  - DEQ
  - Tribal Governments
  - Resource Agencies (ODFW, NMFS, etc.)
  - Public

Attachments

Attachment 1 – Project Electronic Data Deliverable

Electronic Data Delivery Overview

Table C.1-1. Project Electronic Data Deliverables (EDD)

EDD	Description
Locational, Station, and Sample EDD	Facility, location, and sample information.
Lab Results EDD	Laboratory analytical results as well as analytical data qualification and validation.

Page left blank intentionally.

Table C.1-2. Project Site, Locational, And Sample Information EDDs

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
SiteName[1]	Text	50	The name of the site (project, facility, etc.) from which the samples were taken.	Portland Harbor Superfund Site	Sites
StationName	Text	50	The name of the sample location (well, grab sample, etc…). from which the sample was taken.	See the SAP for station naming conventions.	Stations
GroundElevation	Number(Sg)		The ground elevation at the station.	Not Applicable	Stations
DatumElevation	Number(Sg)		The datum elevation at the station.	Not Applicable	Stations
StationTypeCode	Text	15	A code for the type of station.	Not Applicable	Stations
StationDate_D	Date/Time		The date the station was activated.	Not Applicable	Stations
Location_LL_LX	Number(Db)		The longitude coordinate of the station.	Not Applicable	Stations
Location_LL_LY	Number(Db)		The latitude coordinate of the station.	Not Applicable	Stations
Location_CX	Number(Db)		The easting coordinate of the station in international feet.	Not Applicable	Stations
Location_CY	Number(Db)		The northing coordinate of the station in international feet.	Not Applicable	Stations
SampleBottom	Number(Sg)		The elevation at the top of the sample in units of centimeters.	0	Samples
DepthUnits	Text	15	Units for sample top and sample bottom. This field is linked to the **ReportingUnits** lookup table. If this information is unavailable to the lab, "Unknown" should be reported.	Not Applicable	Samples
Duplicate	Number(Int)4		This field is used when more than one physical sample is taken in the field from the same station on the same date, for the same matrix, at the same depth. If the data	0	Samples

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
			provider fills in this field, then each analysis must have an entry for this field, with multiple QC samples entered as Duplicate values incremented from zero. For example, an original sample would be 0, a duplicate 1, a matrix spike 2, and a matrix spike duplicate 3, and so on.		
FieldSampleID	Text	40	The assigned sample identifier for each sample.	See the SAP for Sample naming conventions.	Samples
AltSampleID	Text	40	An additional sample ID, if required.	Not Applicable	Samples
CoolerID	Text	40	A unique identifier for the cooler in which the primary and QC samples were shipped.	Not Applicable	Samples
Sampler	Text	50	Name or initials of the person taking the sample.	Not Applicable	Samples
Description	Text	50	A description of the sample condition.	Not Applicable	Samples
SampleMethodCode	Text	4	Code for method used to collect the sample. Entries must exist in the SamplingMethod look-up table.	Not Applicable	Samples
LogCode	Text	4	A coded value identifying the company collecting samples or performing field tests.	Not Applicable	Samples
COCNumber	Text	40	Chain-of-custody tracking number.	Not Applicable	Samples
AmbientBlankLot	Text	8	Ambient blank field lot identifier	Not Applicable	Samples
EquipmentBlankLot	Text	8	Equipment blank field lot identifier	Not Applicable	Samples
TripBlankLot	Text	8	Trip blank field lot identifier	Not Applicable	Samples
FilteredSample	Text	20	Sample level filter information describing if the sample was filtered, and if so, what	Not Applicable	Samples

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
			size filter was used. Entries must conform to values found in the Filtered look-up table.		
QCSequenceID	Text	40	QC sequence identifier, used for lab tracing to related field samples to lab samples.	Not Applicable	Samples
QCSampleCode	Text	3	A code to identify QC samples as found in the QCCodes table.	Not Applicable	Samples
TaskNumber	Text	40	The administrative task number under which sampling is occurring.	Not Applicable	Samples
PrimarySample	Text	40	The primary sample to which the QC sample is tied.	Not Applicable	Samples
SampleResult	Text	255	The result of the sampling process, such as "Successful", "Dry", or "No Access". The primary purpose of this field is to record if a sample attempt was unsuccessful.	Not Applicable	Samples
Container	Text	255		Not Applicable	Samples
NumContainers	Number (Int)		Number of sample containers	Not Applicable	Samples
CoolerTemp	Number(Sgl)		Cooler temperature upon receipt	Not Applicable	Samples
FieldEquip	Text	60	Equipment used for field sampling	Not Applicable	Samples
GeologicUnitCode	Text	5	Geologic or Hydrologic unit code of the sample.	Not Applicable	Samples
LithologyCode	Text	5	Lithology or soil type code of the sample.	Not Applicable	Samples
Odor	Text	15	Sample odor upon receipt.	Not Applicable	Samples
Preservation	Text	20	Sample preservation done in field.	Not Applicable	Samples
PumpFault	Text	1	Was there a pump fault?	Not Applicable	Samples
Purged	Text	1	Was the well purged?	Not Applicable	Samples
QAPlanNumber	Text	50	QA Plan under which sampling occurred.	Not Applicable	Samples

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
SampConcentration	Text	20	Sample concentration (low, medium, high).	Not Applicable	Samples
SampleCollProc			The unique identifier of the sample collection procedure.	Not Applicable	Samples
SampleEventID			A numeric link to the SampleEvents lookup table.	Not Applicable	Samples
SamplePurposeCode	Text	2	Key to SamplePurpose table	Not Applicable	Samples
SampleSource	Text	5	Sample source (field, lab)	Not Applicable	Samples
Witness	Text	30	Name of person witnessing sampling	Not Applicable	Samples
TaxonSerial	Text	6	Taxonomy of an organism	Not Applicable	Samples
SamplePurposeCode	Text	2	Key to SamplePurpose table	Not Applicable	Samples
SampleSource	Text	5	The source of the sample (e.g., field or lab).	Not Applicable	Samples
Witness	Text	30	Name of person witnessing sampling	Not Applicable	Samples
TaxonSerial	Text	6	Taxonomy of an organism	Not Applicable	Samples
GenderCode	Text	12	Gender of an organism	Not Applicable	Samples
LifeStageCode	Text	12	Life stage of an organism	Not Applicable	Samples
TissueTypeCode	Text	12	Tissue type of a tissue sample	Not Applicable	Samples
Sample_X	Number(Db)		X (easting) coordinate	Not Applicable	Samples
Sample_Y	Number(Db)		Y (northing) coordinate	Not Applicable	Samples
Sample_Z	Number(Db)		Z (depth or elevation) coordinate	Not Applicable	Samples
FinalValue	Number(Db)		Final value	Not Applicable	Samples
FinalQualifier	Number(Db)		Final qualifier	Not Applicable	Samples
SampleEndDate_D	Date/Time		Date sample ends	Not Applicable	Samples
SampleStatusCode	Text	10	Foreign key to SampleStatus table	Not Applicable	Samples
StationReach	Number(Db)		Distance down or along a linear featur	Not Applicable	Samples

Table C.1-3. Project Analysis Information EDD

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
DeliveryGroup	Text	25	Sample delivery group. The field is provided for use as a lab tracking field to define results for a group of samples reported together.	Not Applicable	Analyses
ParameterName	Text	620	Name of material analyzed for Analyses	Not Applicable	Analyses
CASNumber	Text	20	CAS number of material analyzed for Analyses	Not Applicable	Analyses
AltParamNumber	Text	20	Alternative number for parameter	Not Applicable	Analyses
Superseded	Number(Int)		Analysis superseded by re-analysis? [8]	Not Applicable	Analyses
DeliveryGroup	Text	25	Sample delivery group. The field is provided for use as a lab tracking field to define results for a group of samples reported together.	Not Applicable	Analyses
ParameterName	Text	620	Name of material analyzed for Analyses	Not Applicable	Analyses
CASNumber	Text	20	CAS number of material analyzed for Analyses	Not Applicable	Analyses
AltParamNumber	Text	20	Alternative number for parameter	Not Applicable	Analyses
Superseded	Number(Int)		Analysis superseded by re-analysis? 8	Not Applicable	Analyses
AnalyticMethod	Text	40	Method for performing analysis	Not Applicable	Analyses
Value	Text10	25	Value measured during analysis	Not Applicable	Analyses
ReportingUnits	Text	15	Units of the analysis Analyses	Not Applicable	Analyses
FlagCode	Text	20	Data qualifier Analyses	Not Applicable	Analyses
ProblemCode	Text	20	Problems encountered during analysis	Not Applicable	Analyses
ValidationCode	Text	20	Code from data validation	Not Applicable	Analyses
DetectedResult	Text	1	Was analyte detected (y/n)?	Not Applicable	Analyses
Detect	Number(Sg)		Detection limit	Not Applicable	Analyses

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
LimitType	Text	4	Detection limit type	Not Applicable	Analyses
Detect2	Number(Sg)		2nd detection limit	Not Applicable	Analyses
LimitType2	Text	4	2nd detection limit type	Not Applicable	Analyses
Detect3	Number(Sg)		3rd detection limit	Not Applicable	Analyses
LimitType3	Text	4	3rd detection limit type	Not Applicable	Analyses
Detect4	Number(Sg)		4th detection limit	Not Applicable	Analyses
LimitType4	Text	4	4th detection limit type	Not Applicable	Analyses
Detect5	Number(Sg)		5th detection limit	Not Applicable	Analyses
LimitType5	Text	4	5th detection limit type	Not Applicable	Analyses
SpikeAmount	Number(Sg)		Spike amount added to the sample	Not Applicable	Analyses
RetentionTime	Number(Sg)		Retention time for this analysis	Not Applicable	Analyses
Error	Number(Sg)		Error range for this analysis	Not Applicable	Analyses
DilutionFactor	Number(Sg)		Dilution factor	Not Applicable	Analyses
Basis	Text	1	Analyzed wet or dry	Not Applicable	Analyses
FilteredAnalysis	Text	20	Filtered status at analytical level	Not Applicable	Analyses
LeachMethod	Text	20	Leaching method	Not Applicable	Analyses
LeachateBatch	Text	12	Leachate batch	Not Applicable	Analyses
LeachDate_D	Date/Time		Date sample was leached	Not Applicable	Analyses
PrepMethod	Text	40	Lab preparation method	Not Applicable	Analyses
PreparationLot	Text	10	Batch designator for samples and assoc. QC	Not Applicable	Analyses
ReportableResult	Text	1	Is this a reportable result (y/n)?	Not Applicable	Analyses
AnalDate_D	Date/Time		Date the analysis was performed	Not Applicable	Analyses
ExtractDate_D	Date/Time		Date the extraction was performed	Not Applicable	Analyses
LabReportDate_D	Date/Time		Lab analysis reporting date	Not Applicable	Analyses

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
LabRecvDate_D	Date/Time		Date the lab received the sample	Not Applicable	Analyses
Lab	Text	20	Name of lab conducting analysis	Not Applicable	Analyses
LabComments	Text	50	Lab comments about this analysis	Not Applicable	Analyses
AnalysisLabID	Text	40	Lab identification number for analysis	Not Applicable	Analyses
AnalyticalBatch	Text	40	Lab batch ID number	Not Applicable	Analyses
ValueCode	Text	6	Differentiates between different results	Not Applicable	Analyses
RunCode	Text	5	Run code for GC analyses	Not Applicable	Analyses
LimitType5	Text	4	5th detection limit type	Not Applicable	Analyses
SpikeAmount	Number(Sg)		Spike amount added to the sample	Not Applicable	Analyses
RetentionTime	Number(Sg)		Retention time for this analysis	Not Applicable	Analyses
Error	Number(Sg)		Error range for this analysis	Not Applicable	Analyses
DilutionFactor	Number(Sg)		Dilution factor	Not Applicable	Analyses
Basis	Text	1	Analyzed wet or dry	Not Applicable	Analyses
FilteredAnalysis	Text	20	Filtered status at analytical level	Not Applicable	Analyses
LeachMethod	Text	20	Leaching method	Not Applicable	Analyses
LeachateBatch	Text	12	Leachate batch	Not Applicable	Analyses
LeachDate_D	Date/Time		Date sample was leached	Not Applicable	Analyses
PrepMethod	Text	40	Lab preparation method	Not Applicable	Analyses
PreparationLot	Text	10	Batch designator for samples and assoc. QC	Not Applicable	Analyses
ReportableResult	Text	1	Is this a reportable result (y/n)?	Not Applicable	Analyses
AnalDate_D	Date/Time		Date the analysis was performed	Not Applicable	Analyses
ExtractDate_D	Date/Time		Date the extraction was performed	Not Applicable	Analyses
LabReportDate_D	Date/Time		Lab analysis reporting date	Not Applicable	Analyses
LabRecvDate_D	Date/Time		Date the lab received the sample	Not Applicable	Analyses

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
Lab	Text	20	Name of lab conducting analysis	Not Applicable	Analyses
LabComments	Text	50	Lab comments about this analysis	Not Applicable	Analyses
AnalysisLabID	Text	40	Lab identification number for analysis	Not Applicable	Analyses
AnalyticalBatch	Text	40	Lab batch ID number	Not Applicable	Analyses
ValueCode	Text	6	Differentiates between different results	Not Applicable	Analyses
RunCode	Text	5	Run code for GC analyses	Not Applicable	Analyses
QCAnalysisCode	Text	3	QC code for this analysis	Not Applicable	Analyses
AnalysisGroup	Text	20	Group of methods for this analysis	Not Applicable	Analyses
AnalysisLocationCode	Text	2	Where the analysis was done	Not Applicable	Analyses
BatchTypeCode	Text	2	Type of batch Analyses	Not Applicable	Analyses
Cleanup	Text	50	Cleanup method performed by lab	Not Applicable	Analyses
DetectorMode	Text	50	Detector mode	Not Applicable	Analyses
DetectorType	Text	50	Detector type	Not Applicable	Analyses
ExpectedValue	Number(Db)		Expected value for standard	Not Applicable	Analyses
Extracted	Text	1	Is this anextracted sample?	Not Applicable	Analyses
HandlingBatch	Text	12	Batch identifier for lab handling (extracted, etc.)	Not Applicable	Analyses
HandlingType	Text	50	Handling of sample prior to analysis	Not Applicable	Analyses
InstrumentCalibBy	Text	50	Instrument calibrated by (name	Not Applicable	Analyses
InstrumentCalibDate_D	Date/Time		Date instrument was calibrated	Not Applicable	Analyses
InstrumentManufacturer	Text	50	Manufacturer of instrument	Not Applicable	Analyses
InstrumentModel	Text	50	Model of instrument	Not Applicable	Analyses
InstrumentNum	Text	20	Serial number of instrument	Not Applicable	Analyses
LabMatrixCode	Text	2	Matrix as analyzed in lab	Not Applicable	Analyses
LabPrepDate_D	Date/Time		Date sample was prepped at lab	Not Applicable	Analyses
LabReportNum	Text	20	LabReportNumber	Not Applicable	Analyses

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
LabSampleID	Text	40	Lab sample ID	Not Applicable	Analyses
MethodBatch	Text	12	Batch identifier for analyses by one method	Not Applicable	Analyses
NumberDecimals	Number(Int)		Number of decimal places displayed on report	Not Applicable	Analyses
PercentRecovery	Number(Sg)		Percent recovery for spike or tracer yield	Not Applicable	Analyses
PrepBatch	Text	12	Batch identifier for lab prep	Not Applicable	Analyses
PreserveIntact	Text	1	Was the preservation intact on arrival at lab?	Not Applicable	Analyses
RunBatch	Text	12	Batch for run with same initial calibration	Not Applicable	Analyses
StatTypeCode	Text	2	Key to StatisticalTypes(Min, Max, Mean)	Not Applicable	Analyses
StdRefMaterial	Text	8	Standard reference material for analysis	Not Applicable	Analyses
SubcontractLab	Text	20	Subcontracted lab	Not Applicable	Analyses
ValidationComments	Text	50	Reason for selecting validation cod	Not Applicable	Analyses
Validator	Text	20	Person or company name providing validation	Not Applicable	Analyses
ValueTypeCode	Text	2	Key to ValueTypes(Actual, estimated, etc.)	Not Applicable	Analyses
WeightVolume	Number(Db		Weight or volume of sample. Moved from sample	Not Applicable	Analyses
WeightVolUnits	Text	4	Key to ReportingUnits for weight or vol of sample analyzed	Not Applicable	Analyses
UpperControlLimit	Number(Sg)		Upper control limit for validation	Not Applicable	Analyses
LowerControlLimit	Number(Sg)		Lower control limit for validation	Not Applicable	Analyses
RejectionControlLimit	Number(Sg)		Rejection limit for validation	Not Applicable	Analyses
RPDLimit	Number(Int)		Relative percentage difference limit for validation	Not Applicable	Analyses
APDLimit	Number(Int)		Absolute percentage difference limit for validation	Not Applicable	Analyses
CatResult	Text	20	Categorical (non-numeric) result	Not Applicable	Analyses
AnalysesTaxonSerial	Text	6	Taxonomy of organisms in a bulk sample	Not Applicable	Analyses
AnalysesLifeStageCode	Text	12	Life stage of organisms in a bulk sample	Not Applicable	Analyses

Field Name	Data Type	Field Size[6]	Description	Default Project Value	Table[9]
BlankFlagCode	Text	12	Flag to identify results from blank	Not Applicable	Analyses
FinalValue	Number(Db)		Final value	Not Applicable	Analyses
FinalQualifier	Number(Db)		Final qualifier	Not Applicable	Analyses

Attachment 2 – Scribe.NET Data Elements

Page left blank intentionally.

Table C.1-4 Scribe.NET Data Elements

Table Name	Field Name	Type	Size	Description
ActionLevels	Site_No	10	12	
ActionLevels	SourceID	10	100	
ActionLevels	Matrix	10	40	
ActionLevels	Analyte	10	60	
ActionLevels	CAS_NO	10	50	
ActionLevels	Value	7	8	
ActionLevels	Unit	10	20	
ActionLevels	Notes	10	255	
ActionLevels	ActionLevelDBID	4	4	
COC	COCId	4	4	Database Autonumber
COC	Site_No	10	12	Site Number (PK, FK)
COC	COC	10	30	Chain of Custody Number (PK)
COC	CaseNumber	10	10	CLP CaseNumber
COC	CaseComplete	1	1	Case Complete?
COC	COC_Contact	10	50	COC Contact
COC	COC_ContactPhone	10	50	COC Contact Phone Number
COC	Lab	10	50	Lab COC sent to
COC	Lab_Contact	10	30	Lab Contact
COC	Lab_Phone	10	20	Lab Phone Number
COC	Lab_Fax	10	20	Lab Fax
COC	Lab_Address	10	150	Lab Address
COC	Lab_Address2	10	50	Lab Address2
COC	Lab_City	10	40	Lab City
COC	Lab_State	10	20	Lab State
COC	Lab_Zip	10	20	Lab Zip
COC	Lab_Remark	10	250	
COC	Cooler_No	10	20	The COC Cooler Number

Table Name	Field Name	Type	Size	Description
COC	CarrierName	10	50	The Carrier used to ship the COC
COC	AirbillNo	10	50	Airbill number
COC	DateShipped	8	8	Date COC shipped
COC	Remark	12	0	Remark
COC	COC_Format	10	50	Scribe, CLP Generic, CLP Organics, CLP Inorganics
COC	ProjectCode	10	50	Regional Project Code
COC	Date_Input	8	8	System Date
COC	Date_Edit	8	8	System Date
COC	Edited_By	10	20	System Edited by
COC	DASNumber	10	50	
EDDAirSampling	RecordId	4	4	System field
EDDAirSampling	UnitID	4	4	System field
EDDAirSampling	UserName	10	255	System field
EDDAirSampling	TimeStamp	8	8	System field
EDDAirSampling	SampleCounter	7	8	System field
EDDAirSampling	Site_No	10	12	Site Number (Required)
EDDAirSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (Required)
EDDAirSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDAirSampling	Location	10	50	Sampling Location Code (Required)
EDDAirSampling	Sub_Location	10	25	Sampling Sub Location (i.e. Fence Line, Perimeter. For residential: Living Room, Kitchen, etc.)
EDDAirSampling	SampleDate	8	8	Date Sample Taken
EDDAirSampling	SampleTime	10	5	Time Sample Taken (hh:mm)
EDDAirSampling	SampleType	10	30	Sample Type (i.e. Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
EDDAirSampling	Activity	10	50	Sampling Activity
EDDAirSampling	Matrix	10	40	Sample Matrix (i.e. Air, Vapor)

Table Name	Field Name	Type	Size	Description
EDDAirSampling	SampleMedia	10	30	Sampling Media (i.e. Summa Canister)
EDDAirSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDAirSampling	Volume	7	8	Air Sampling Volume. Wipe Sampling Area.
EDDAirSampling	Volume_Units	10	20	Volume Units
EDDAirSampling	Samp_Concentration	10	20	Sample Concentration (i.e. low, medium, high)
EDDAirSampling	Sampler	10	30	Sampler Name
EDDAirSampling	Witness	10	30	Witness Name
EDDAirSampling	LinkSampleNo	10	25	Linked Sample Number
EDDAirSampling	Image_Path	10	100	Image File Path
EDDAirSampling	Remarks	10	250	Remarks
EDDAirSampling	Task_ID	10	4	Scribe System Task_ID (FK)
EDDAirSampling	Start_Date	8	8	Air Sampling Start Date
EDDAirSampling	Start_Time	8	8	Air Sampler Start time (hh:mm)
EDDAirSampling	SamplerID	10	50	Air Sampler Equipment ID - Pump #
EDDAirSampling	Date_Cal	8	8	Date Sampler Calibrated
EDDAirSampling	Media_Type	10	30	Air High Vol Sampling
EDDAirSampling	Media_Items	10	50	Air High Vol Sampling
EDDAirSampling	Flow_Units	10	20	Flow Rate Units (i.e. Liters)
EDDAirSampling	Pre_Cal	7	8	Start Flow Rate
EDDAirSampling	Start_Count	7	8	Air Sampler Start Counter
EDDAirSampling	Stop_Date	8	8	Air Sampling Stop Date
EDDAirSampling	Stop_Time	8	8	Air Sampler Stop time (hh:mm)
EDDAirSampling	Pump_Fault	10	1	Pump Fault (Y,N)
EDDAirSampling	Orifice_ID	10	50	Orifice ID
EDDAirSampling	Post_Cal	7	8	Stop Flow Rate
EDDAirSampling	Avg_Flow	7	8	Average Flow Rate
EDDAirSampling	Stop_Count	7	8	Air Sampler Stop Counter

Table Name	Field Name	Type	Size	Description
EDDAirSampling	Time_Counter	10	10	Use Sampling Time or Sampler Counter to calculate time. (Values: Counter, Time)
EDDAirSampling	Total_Time	7	8	Total Sampling time
EDDAirSampling	Start_Temperature	7	8	Start Temperature (F)
EDDAirSampling	Start_Pressure	7	8	Start Pressure (Hg)
EDDAirSampling	Stop_Temperature	7	8	Stop Temperature
EDDAirSampling	Stop_Pressure	7	8	Stop Pressure
EDDAirSampling	Pre_Magnehelic	7	8	Starting Magnehelic reading
EDDAirSampling	Post_Magnehelic	7	8	Ending Magnehelic reading
EDDAirSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDAirSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDAirSampling	COC	10	30	Chain of Custody Number (FK)
EDDAirSampling	Coll_Method	10	30	Collection Method
EDDAirSampling	Container	10	30	Sample Container
EDDAirSampling	No_Container	7	8	Number of Containers
EDDAirSampling	Storage	10	30	Sample Storage
EDDAirSampling	Preservation	10	30	Sample Preservation
EDDAirSampling	Analyses	10	64	Lab Analyses for this sample (FK)
EDDAirSampling	Tag_Matrix	10	20	Tag Matrix
EDDAirSampling	Tag_Measurement	7	8	Tag Measurement
EDDAirSampling	Tag_Units	10	20	Tag Units of measurement
EDDAirSampling	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)
EDDAirSampling	Description	10	30	Sample Analyses Description
EDDAirSampling	PropertyID	10	50	Property ID (FK)
EDDAirSampling	LocationDescription	10	100	Location Description further describes the Sample Location
EDDAirSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDAirSampling	Latitude	7	8	Latitude

Table Name	Field Name	Type	Size	Description
EDDAirSampling	Longitude	7	8	Longitude
EDDAirSampling	Altitude	7	8	Altitude
EDDAirSampling	Northing	7	8	Northing
EDDAirSampling	Easting	7	8	Easting
EDDAirSampling	Datum	10	50	Datum of the station coordinates
EDDAirSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates (i.e. GPS, Interpolation, Survey)
EDDAirSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDAirSampling	Surf_Elev	7	8	Surface Elevation
EDDAirSampling	Surf_Units	10	20	Surface Elevation Units
EDDAirSampling	ElevMethod	10	60	Method used to determine the elevation measurement (i.e., Altimetry, GPS, Interpolation, Other, Survey)
EDDAirSampling	ElevDatum	10	50	Datum used to determine the elevation measurement. (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
EDDAirSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system (i.e., UTM NAD83)
EDDAirSampling	LocationComment	10	250	Location Comment
EDDAirSampling	Location_Image_Path	10	255	Location Image Path to related image file

Table Name	Field Name	Type	Size	Description
EDDAirSampling	Imported	10	1	Scriblets System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDAirSampling	Preliminary_Results	1	1	
EDDAirSampling	Tared_Weight	7	8	
EDDAirSampling	Final_Weight	7	8	
EDDAirSampling	Sample_Weight	7	8	
EDDAirSampling	TAT	7	8	
EDDAirSampling	TAT_Units	10	25	
EDDBiotaSampling	RecordId	4	4	System field
EDDBiotaSampling	UnitID	4	4	System field
EDDBiotaSampling	UserName	10	255	System field
EDDBiotaSampling	TimeStamp	8	8	System field
EDDBiotaSampling	SampleCounter	7	8	System field
EDDBiotaSampling	Site_No	10	12	Site Number (Required)
EDDBiotaSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (Required)
EDDBiotaSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDBiotaSampling	Location	10	50	Sampling Location Code (Required)
EDDBiotaSampling	Sub_Location	10	25	Sub Location. i.e. further describe Location info. i.e. Living Room. Does NOT relate to the Location table
EDDBiotaSampling	SampleDate	8	8	Date Sample Taken
EDDBiotaSampling	SampleTime	10	5	Time Sample taken (hh:mm)
EDDBiotaSampling	SampleType	10	30	Sample Type (i.e. Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
EDDBiotaSampling	Activity	10	50	Sampling Activity
EDDBiotaSampling	Matrix	10	40	Sample Matrix (i.e., Biota)
EDDBiotaSampling	SampleMedia	10	30	Sampling Media

Table Name	Field Name	Type	Size	Description
EDDBiotaSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDBiotaSampling	Samp_Concentration	10	20	Sample Concentration (low, medium, high)
EDDBiotaSampling	Sampler	10	30	Sampler Name
EDDBiotaSampling	Witness	10	30	Witness Name
EDDBiotaSampling	LinkSampleNo	10	25	Linked Sample Number
EDDBiotaSampling	Image_Path	10	100	Image File Path
EDDBiotaSampling	Remarks	10	250	Remarks
EDDBiotaSampling	Task_ID	10	4	System Assigned Task_ID (FK)
EDDBiotaSampling	LiveDead	10	20	Sample Taken Alive or Dead. Values: Live, Dead
EDDBiotaSampling	TrapType	10	20	Trap Type
EDDBiotaSampling	WholePart	10	20	Whole or Partial Sample Taken
EDDBiotaSampling	Maturity	10	20	Relative Age Class
EDDBiotaSampling	FP	10	20	Fresh or Preserved
EDDBiotaSampling	Age	7	8	Age
EDDBiotaSampling	AgedBy	10	20	Aged By Units
EDDBiotaSampling	Genus	10	50	Genus
EDDBiotaSampling	Species	10	50	Species
EDDBiotaSampling	ComName	10	50	Common Name
EDDBiotaSampling	Family	10	50	Family
EDDBiotaSampling	SPCode	10	3	SPCode
EDDBiotaSampling	Sex	10	20	Male, Female
EDDBiotaSampling	TotalLength	7	8	measurement
EDDBiotaSampling	WholeWeight	7	8	measurement
EDDBiotaSampling	TailLength	7	8	measurement
EDDBiotaSampling	HindFootLength	7	8	measurement
EDDBiotaSampling	EarLength	7	8	measurement
EDDBiotaSampling	ForkLength	7	8	measurement
EDDBiotaSampling	StandardLength	7	8	measurement

Table Name	Field Name	Type	Size	Description
EDDBiotaSampling	FiletWeight	7	8	measurement
EDDBiotaSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDBiotaSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDBiotaSampling	COC	10	30	Chain of Custody Number (FK)
EDDBiotaSampling	Coll_Method	10	30	Collection Method
EDDBiotaSampling	Container	10	30	Sample Container
EDDBiotaSampling	No_Container	7	8	Number of Containers
EDDBiotaSampling	Storage	10	30	Sample Storage
EDDBiotaSampling	Preservation	10	30	Sample Preservation
EDDBiotaSampling	Analyses	10	64	Lab Analyses for this sample (FK)
EDDBiotaSampling	Tag_Matrix	10	20	Tag matrix - i.e. Small Mammal Matrix (liver, etc.)
EDDBiotaSampling	Tag_Measurement	7	8	Tag Measurement (i.e. Tag Weight)
EDDBiotaSampling	Tag_Units	10	20	Tag Units i.e. units of measurement
EDDBiotaSampling	MS_MSD	10	1	Y or N. Matrix Spike/Matrix Spike Duplicate
EDDBiotaSampling	Description	10	30	Sample Analyses Description
EDDBiotaSampling	PropertyID	10	50	Property ID (FK)
EDDBiotaSampling	LocationDescription	10	100	Location Description further describes the Sample Location
EDDBiotaSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDBiotaSampling	Latitude	7	8	Latitude
EDDBiotaSampling	Longitude	7	8	Latitude
EDDBiotaSampling	Altitude	7	8	Altitude
EDDBiotaSampling	Northing	7	8	Northing
EDDBiotaSampling	Easting	7	8	Easting
EDDBiotaSampling	Datum	10	50	Datum of the station coordinates
EDDBiotaSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. Values: GPS, Interpolation, Survey

Table Name	Field Name	Type	Size	Description
EDDBiotaSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDBiotaSampling	Surf_Elev	7	8	Surface Elevation
EDDBiotaSampling	Surf_Units	10	20	Surface Elevation Units
EDDBiotaSampling	ElevMethod	10	60	Method used to determine the elevation measurement. i.e. Altimetry, GPS, Interpolation, Other, Survey
EDDBiotaSampling	ElevDatum	10	50	Datum used to determine the elevation measurement (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
EDDBiotaSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system (i.e., UTM NAD83)
EDDBiotaSampling	LocationComment	10	250	Location Comment
EDDBiotaSampling	Location_Image_Path	10	255	Location Image Path. File path to related image file.
EDDBiotaSampling	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDBiotaSampling	Preliminary_Results	1	1	
EDDBiotaSampling	Tared_Weight	7	8	
EDDBiotaSampling	Final_Weight	7	8	
EDDBiotaSampling	Sample_Weight	7	8	
EDDBiotaSampling	TAT	7	8	
EDDBiotaSampling	TAT_Units	10	25	
EDDLabAnalyses	LabAnalysesID	4	4	System field

Table Name	Field Name	Type	Size	Description
EDDLabAnalyses	Site_No	10	12	Site Number (Required)
EDDLabAnalyses	Analyses_Type	10	20	Analyses Type (i.e. Organics, Inorganics, RCRA, USER_DEFINED, Other)
EDDLabAnalyses	Program_Type	10	10	The Program (i.e. CLP or Non-CLP)
EDDLabAnalyses	Analyses_ID	10	4	System field
EDDLabAnalyses	Analyses	10	50	Analysis Name (i.e., VOCs, PCBs, Metals TAL) (Required)
EDDLabAnalyses	Analyses_Abbrev	10	20	Analyses Abbrev
EDDLabAnalyses	Turnaround	7	8	The Turnaround Time assigned to the analysis.
EDDLabAnalyses	Turnaround_Units	10	25	Turnaround time units for the analysis (i.e. Days, Hours)
EDDLabAnalyses	LabQCType	10	50	Lab QC to be done on the analysis
EDDLabAnalyses	Analytical_Method	10	100	Analytical Method
EDDLabAnalyses	Analyses_Comment	10	100	Analyses Comment
EDDLabAnalyses	Analyses_Container	10	30	
EDDLabAnalyses	Analyses_Preservation	10	30	
EDDMonitoringData	RecordId	4	4	System field
EDDMonitoringData	UnitID	4	4	System field
EDDMonitoringData	UserName	10	255	System field
EDDMonitoringData	TimeStamp	8	8	System field
EDDMonitoringData	SampleCounter	7	8	System field
EDDMonitoringData	Site_No	10	12	Site Number. (Required)
EDDMonitoringData	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Monitoring' (i.e. EOC, Site Assessment)
EDDMonitoringData	InstrumentID	10	50	Instrument ID (Required)
EDDMonitoringData	Location	10	50	Monitoring Location Code (Required)
EDDMonitoringData	Sub_Location	10	30	Sampling Sub Location (i.e. Fence Line, Perimeter. For residential: Living Room, Kitchen, etc.)
EDDMonitoringData	Activity	10	50	Monitoring Activity

Table Name	Field Name	Type	Size	Description
EDDMonitoringData	Mon_Date	8	8	Monitoring Date (Required)
EDDMonitoringData	Mon_Time	10	30	Monitoring Time (hh:mm:ss) (Required)
EDDMonitoringData	Mon_Operator	10	50	Monitoring/Sampler Name
EDDMonitoringData	Mon_Parameter	10	50	Monitoring Parameter. i.e. Mercury (Required)
EDDMonitoringData	Mon_Measurement	7	8	Monitoring Measurement
EDDMonitoringData	Mon_Meas_Units	10	40	Monitoring Measurement Units
EDDMonitoringData	Mon_Qualifier	10	10	Monitoring Criteria such as detection limit, action limit or other criteria
EDDMonitoringData	Mon_Criteria	7	8	Monitoring Criteria such as detection limit, action limit or other criteria
EDDMonitoringData	Mon_Criteria_Units	10	20	Monitoring Criteria Units
EDDMonitoringData	Mon_Source	10	50	Monitoring Source (i.e. Radiation Type/Energy)
EDDMonitoringData	Mon_Meas_Surface	10	50	Monitoring Measurement Surface (i.e. concrete)
EDDMonitoringData	Mon_Remark	10	255	Monitoring Data Remark
EDDMonitoringData	Instrument_Descr	10	100	Instrument Description (i.e. Photo Ion Detector, HNU)
EDDMonitoringData	Instrument_SN	10	50	Instrument SN (i.e. A11198)
EDDMonitoringData	Instrument_Manufacturer	10	50	Instrument Manufacturer (i.e. HNU Systems)
EDDMonitoringData	Instrument_Model	10	50	Instrument Model (i.e. ISPI-101)
EDDMonitoringData	Instrument_Type	10	50	Instrument Type (i.e. PID/FID)
EDDMonitoringData	Instrument_Cal_Date	8	8	Instrument Calibration Date
EDDMonitoringData	Instrument_Cal_By	10	50	Instrument Calibrated By
EDDMonitoringData	Instrument_Cal_Isotope	10	50	Instrument Calibration Isotope
EDDMonitoringData	Instrument_Efficiency	10	50	Instrument Efficiency
EDDMonitoringData	Instrument_Ref_Cal_Point	10	50	Instrument Ref Cal Point
EDDMonitoringData	Instrument_Remark	10	255	Instrument Remark
EDDMonitoringData	Detector_ID	10	50	Detector ID
EDDMonitoringData	Detector_Type	10	50	Detector Type
EDDMonitoringData	Detector_Mode	10	50	Detector Mode

Table Name	Field Name	Type	Size	Description
EDDMonitoringData	PropertyID	10	50	Property Id (FK)
EDDMonitoringData	LocationDescription	10	100	Location Description
EDDMonitoringData	LocationZone	10	25	Describes the area impacted relative to the site
EDDMonitoringData	Latitude	7	8	Latitude
EDDMonitoringData	Longitude	7	8	Longitude
EDDMonitoringData	Altitude	7	8	Altitude
EDDMonitoringData	Northing	7	8	Northing
EDDMonitoringData	Easting	7	8	Easting
EDDMonitoringData	Datum	10	50	Datum of the station coordinates
EDDMonitoringData	GeoMethod	10	30	Geopositioning method used to establish Latitude and Longitude coordinates. Values: GPS, Interpolation, Survey
EDDMonitoringData	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDMonitoringData	Surf_Elev	7	8	Surface Elevation
EDDMonitoringData	Surf_Units	10	20	Surface Elevation Units
EDDMonitoringData	ElevMethod	10	30	Method used to determine the elevation measurement. i.e. Altimetry, GPS, Interpolation, Other, Survey
EDDMonitoringData	ElevDatum	10	50	Datum used to determine the elevation measurement (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown

Table Name	Field Name	Type	Size	Description
EDDMonitoringData	Coord_Sys_Desc	10	70	Sampling location coordinate system (i.e., UTM NAD83)
EDDMonitoringData	LocationComment	10	250	Location Comment
EDDMonitoringData	Location_Image_Path	10	255	Location Image Path to related image file.
EDDMonitoringData	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDMonitoringData	EDD_File_Name	10	100	
EDDProperty	RecordId	4	4	System field
EDDProperty	UnitID	4	4	System field
EDDProperty	UserName	10	255	System field
EDDProperty	TimeStamp	8	8	System field
EDDProperty	SampleCounter	7	8	System field
EDDProperty	Site_No	10	12	Site Number (Required PK)
EDDProperty	PropertyID	10	50	Property ID (Required PK)
EDDProperty	PropertyType	10	15	i.e., residential, commercial
EDDProperty	PropertyAccessAgreement	1	1	Access Agreement Yes/No
EDDProperty	OwnerOccupied	1	1	Owner Occupied Yes/No
EDDProperty	TennantOccupied	1	1	Tenant Occupied Yes/No
EDDProperty	PropertyZone	10	25	Property Zone
EDDProperty	PropertyTaxID	10	50	Property Tax ID
EDDProperty	PropertyBlockID	10	25	Property Block Number
EDDProperty	PropertyParcelID	10	25	Parcel Identifier
EDDProperty	PropertyFirstName	10	50	Property Contact's First Name
EDDProperty	PropertyLastName	10	50	Property Contact's Last Name (Tenant)
EDDProperty	PropertyPhone	10	50	Property Phone
EDDProperty	PropertyAddress	10	50	Property Address
EDDProperty	PropertyAddress2	10	50	Property Address2
EDDProperty	PropertyCity	10	50	Property City
EDDProperty	PropertyState	10	20	Property State

Table Name	Field Name	Type	Size	Description
EDDProperty	PropertyZip	10	20	Property Zip
EDDProperty	OwnerLastName	10	50	Owner Last Name
EDDProperty	OwnerFirstName	10	50	Owner First Name
EDDProperty	OwnerAddress	10	50	Owner Address
EDDProperty	OwnerAddress2	10	50	Owner Address2
EDDProperty	OwnerCity	10	50	Owner City
EDDProperty	OwnerState	10	20	Owner State
EDDProperty	OwnerZip	10	20	Owner Zip
EDDProperty	OwnerPhone	10	50	Owner Phone
EDDProperty	OwnerAlternateNumber	10	50	Alternate Phone #
EDDProperty	PropertyAccessRequestedDate	8	8	Access Requested Date
EDDProperty	PropertyAccessApprovedDate	8	8	Access Approved Date
EDDProperty	PropertyDate1	8	8	i.e., Date Exterior Access Requested
EDDProperty	PropertyDate2	8	8	i.e., Date Interior Access Requested
EDDProperty	PropertyDate3	8	8	i.e., Date Interior Access Approved
EDDProperty	PropertyDate4	8	8	i.e., Date Interior Access Denied
EDDProperty	PropertyDate5	8	8	i.e., Date Exterior Access Approved
EDDProperty	PropertyDate6	8	8	i.e., Date Exterior Access Denied
EDDProperty	PropertyX	7	8	X Coordinate
EDDProperty	PropertyY	7	8	Y Coordinate
EDDProperty	PropertyComment	10	250	Property Comment
EDDProperty	OccupantID	10	25	Unique Occupant Identifier (FK)
EDDProperty	OccupantLastName	10	50	Occupant LastName
EDDProperty	OccupantFirstName	10	50	Occupant FirstName
EDDProperty	OccupantAge	7	8	Occupant Age
EDDProperty	OccupantAgeUnits	10	30	Occupant Age Units
EDDProperty	OccupantGender	10	30	Occupant Gender
EDDProperty	OccupantDateContacted	8	8	Occupant Date Contacted

Table Name	Field Name	Type	Size	Description
EDDProperty	OccupantRemarks	10	255	Occupant Remarks
EDDSoilGasSampling	RecordId	4	4	System field
EDDSoilGasSampling	UnitID	4	4	System field
EDDSoilGasSampling	UserName	10	255	System field
EDDSoilGasSampling	TimeStamp	8	8	System field
EDDSoilGasSampling	SampleCounter	7	8	System field
EDDSoilGasSampling	Site_No	10	12	Site Number (Required)
EDDSoilGasSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (Required)
EDDSoilGasSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDSoilGasSampling	Location	10	50	Sampling Location Code (Required)
EDDSoilGasSampling	Sub_Location	10	25	Sub Location further describe Sampling Location (Required)
EDDSoilGasSampling	SampleDate	8	8	Date Sample Taken
EDDSoilGasSampling	SampleTime	10	5	Time Sample Taken (hh:mm)
EDDSoilGasSampling	SampleType	10	30	Sample Type (i.e. Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
EDDSoilGasSampling	Activity	10	50	Sampling Activity
EDDSoilGasSampling	Matrix	10	40	Sample Matrix (i.e., Soil, Gas)
EDDSoilGasSampling	SampleMedia	10	30	Sampling Media
EDDSoilGasSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDSoilGasSampling	Samp_Depth	7	8	Sampling Depth
EDDSoilGasSampling	Samp_Depth_To	7	8	Sampling Depth To
EDDSoilGasSampling	Samp_Depth_Units	10	20	Sampling Depth Units
EDDSoilGasSampling	Samp_Concentration	10	20	Sample Concentration (low, medium, high)
EDDSoilGasSampling	Sampler	10	30	Sampler Name
EDDSoilGasSampling	Witness	10	30	Witness Name

Table Name	Field Name	Type	Size	Description
EDDSoilGasSampling	LinkSampleNo	10	25	Linked Sample Number
EDDSoilGasSampling	Image_Path	10	100	Image File Path
EDDSoilGasSampling	Remarks	10	250	Remarks
EDDSoilGasSampling	Task_ID	10	4	Scribe System Task_ID (FK)
EDDSoilGasSampling	Color	10	25	Sample Color
EDDSoilGasSampling	Soil_Descr	10	25	Soil Description (i.e. Sandy/Silty/Clay)
EDDSoilGasSampling	HNU	7	8	measurement
EDDSoilGasSampling	OVA	7	8	measurement
EDDSoilGasSampling	LEL	7	8	measurement
EDDSoilGasSampling	O2	7	8	measurement
EDDSoilGasSampling	Soil_Temp	7	8	measurement
EDDSoilGasSampling	Methane	7	8	measurement
EDDSoilGasSampling	Other1	7	8	measurement
EDDSoilGasSampling	Other2	7	8	measurement
EDDSoilGasSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDSoilGasSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDSoilGasSampling	COC	10	30	Chain of Custody Number (FK)
EDDSoilGasSampling	Coll_Method	10	30	Collection Method
EDDSoilGasSampling	Container	10	30	Sample Container
EDDSoilGasSampling	No_Container	7	8	Number of Containers
EDDSoilGasSampling	Storage	10	30	Sample Storage
EDDSoilGasSampling	Preservation	10	30	Sample Preservation
EDDSoilGasSampling	Analyses	10	64	Lab Analyses for this sample (FK)
EDDSoilGasSampling	Tag_Matrix	10	20	Tag Matrix
EDDSoilGasSampling	Tag_Measurement	7	8	Tag Measurement - i.e. Tag Weight
EDDSoilGasSampling	Tag_Units	10	20	Tag Units i.e. units of measurement
EDDSoilGasSampling	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)
EDDSoilGasSampling	Description	10	30	Sample Analyses Description

Table Name	Field Name	Type	Size	Description
EDDSoilGasSampling	PropertyID	10	50	Property Id (FK)
EDDSoilGasSampling	LocationDescription	10	100	Location Description
EDDSoilGasSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDSoilGasSampling	Latitude	7	8	Latitude
EDDSoilGasSampling	Longitude	7	8	Longitude
EDDSoilGasSampling	Altitude	7	8	Altitude
EDDSoilGasSampling	Northing	7	8	Northing
EDDSoilGasSampling	Easting	7	8	Easting
EDDSoilGasSampling	Datum	10	50	Datum of the station coordinates
EDDSoilGasSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. (i.e. GPS, Interpolation, Survey)
EDDSoilGasSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDSoilGasSampling	Surf_Elev	7	8	Surface Elevation
EDDSoilGasSampling	Surf_Units	10	20	Surface Elevation Units
EDDSoilGasSampling	ElevMethod	10	60	Method used to determine the elevation measurement. (i.e. Altimetry, GPS, Interpolation, Other, Survey)
EDDSoilGasSampling	ElevDatum	10	50	Datum used to determine the elevation measurement. (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown

Table Name	Field Name	Type	Size	Description
EDDSoilGasSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system (i.e UTM NAD83)
EDDSoilGasSampling	LocationComment	10	250	Location Comment
EDDSoilGasSampling	Location_Image_Path	10	255	Location Image Path to related image file
EDDSoilGasSampling	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDSoilGasSampling	Preliminary_Results	1	1	
EDDSoilGasSampling	Tared_Weight	7	8	
EDDSoilGasSampling	Final_Weight	7	8	
EDDSoilGasSampling	Sample_Weight	7	8	
EDDSoilGasSampling	TAT	7	8	
EDDSoilGasSampling	TAT_Units	10	25	
EDDSoilSampling	RecordId	4	4	System field
EDDSoilSampling	UnitID	4	4	System field
EDDSoilSampling	UserName	10	255	System field
EDDSoilSampling	TimeStamp	8	8	System field
EDDSoilSampling	SampleCounter	7	8	Temporary Sample ID
EDDSoilSampling	Site_No	10	12	Site Number (Required)
EDDSoilSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (Required)
EDDSoilSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDSoilSampling	Location	10	50	Sampling Location Code (Required)
EDDSoilSampling	Sub_Location	10	25	Sampling Sub Location (i.e. Fence Line, Perimeter. For residential: Living Room, Kitchen, etc.)
EDDSoilSampling	SampleDate	8	8	Date Sample Taken
EDDSoilSampling	SampleTime	10	5	Time Sample Taken (hh:mm)
EDDSoilSampling	SampleType	10	30	Sample Type (i.e., Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)

Table Name	Field Name	Type	Size	Description
EDDSoilSampling	Activity	10	50	Sampling Activity
EDDSoilSampling	Matrix	10	40	Sample Matrix (i.e., Soil)
EDDSoilSampling	SampleMedia	10	30	Sampling Media
EDDSoilSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDSoilSampling	Samp_Depth	7	8	Sampling Depth
EDDSoilSampling	Samp_Depth_To	7	8	Sampling Depth
EDDSoilSampling	Samp_Depth_Units	10	20	Sampling Depth Units
EDDSoilSampling	Samp_Concentration	10	20	Sample Concentration (low, medium, high)
EDDSoilSampling	Sampler	10	30	Sampler Name
EDDSoilSampling	Witness	10	30	Witness Name
EDDSoilSampling	LinkSampleNo	10	25	Linked Sample Number
EDDSoilSampling	Image_Path	10	100	Image File Path
EDDSoilSampling	Remarks	10	250	Remarks
EDDSoilSampling	Task_ID	10	4	Scribe System Task_ID (FK)
EDDSoilSampling	Color	10	25	Sample Color
EDDSoilSampling	Soil_Descr	10	25	Soil Description (i.e. Sandy/Silty/Clay)
EDDSoilSampling	Munsel_Y	10	30	Munsell Color Code
EDDSoilSampling	Munsel_R	10	30	Munsell Color Code
EDDSoilSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDSoilSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDSoilSampling	COC	10	30	Chain of Custody Number (FK)
EDDSoilSampling	Coll_Method	10	30	Collection Method
EDDSoilSampling	Container	10	30	Sample Container
EDDSoilSampling	No_Container	7	8	Number of Containers
EDDSoilSampling	Storage	10	30	Sample Storage
EDDSoilSampling	Preservation	10	30	Sample Preservation
EDDSoilSampling	Analyses	10	64	Lab Analyses for this sample (FK)

Table Name	Field Name	Type	Size	Description
EDDSoilSampling	Tag_Matrix	10	20	Tag Matrix
EDDSoilSampling	Tag_Measurement	7	8	Tag Measurement (i.e., Tag Weight)
EDDSoilSampling	Tag_Units	10	20	Tag Units of measurement
EDDSoilSampling	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)
EDDSoilSampling	Description	10	30	Sample Analyses Description
EDDSoilSampling	PropertyID	10	50	Property Id (FK)
EDDSoilSampling	LocationDescription	10	100	Location Description
EDDSoilSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDSoilSampling	Latitude	7	8	Latitude
EDDSoilSampling	Longitude	7	8	Longitude
EDDSoilSampling	Altitude	7	8	Altitude
EDDSoilSampling	Northing	7	8	Northing
EDDSoilSampling	Easting	7	8	Easting
EDDSoilSampling	Datum	10	50	Datum of the station coordinates
EDDSoilSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. (Values: GPS, Interpolation, Survey)
EDDSoilSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDSoilSampling	Surf_Elev	7	8	Surface Elevation
EDDSoilSampling	Surf_Units	10	20	Surface Elevation Units
EDDSoilSampling	ElevMethod	10	60	Method used to determine the elevation measurement. (i.e. Altimetry, GPS, Interpolation, Other, Survey)
EDDSoilSampling	ElevDatum	10	50	Datum used to determine the elevation measurement. (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation

Table Name	Field Name	Type	Size	Description
				measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
EDDSoilSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system. (i.e UTM NAD83)
EDDSoilSampling	LocationComment	10	250	Location Comment
EDDSoilSampling	Location_Image_Path	10	255	Location Image Path to related image file
EDDSoilSampling	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDSoilSampling	Preliminary_Results	1	1	
EDDSoilSampling	Tared_Weight	7	8	
EDDSoilSampling	Final_Weight	7	8	
EDDSoilSampling	Sample_Weight	7	8	
EDDSoilSampling	TAT	7	8	
EDDSoilSampling	TAT_Units	10	25	
EDDWaterSampling	RecordId	4	4	System field
EDDWaterSampling	UnitID	4	4	System field
EDDWaterSampling	UserName	10	255	System field
EDDWaterSampling	TimeStamp	8	8	System field
EDDWaterSampling	SampleCounter	7	8	System field
EDDWaterSampling	Site_No	10	12	Site Number (Required)
EDDWaterSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (Required)
EDDWaterSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDWaterSampling	Location	10	50	Sampling Location Code (Required)

Table Name	Field Name	Type	Size	Description
EDDWaterSampling	Sub_Location	10	25	Sub Location. Use to describe Location. For example, for a residential sampling location: Living Room, Basement, etc.
EDDWaterSampling	SampleDate	8	8	Date Sample Taken
EDDWaterSampling	SampleTime	10	5	Time Sample taken. Format used is hh:mm
EDDWaterSampling	SampleType	10	30	Sample Type (i.e. Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
EDDWaterSampling	Activity	10	50	Sampling Activity
EDDWaterSampling	Matrix	10	40	Sample Matrix. i.e. Water, Filtered Water, Ground Water
EDDWaterSampling	SampleMedia	10	30	(i.e., Drainage, Groundwater, Monitoring Well, Residential, Tap)
EDDWaterSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDWaterSampling	Samp_Depth	7	8	Sampling Depth
EDDWaterSampling	Samp_Depth_To	7	8	Sampling Depth
EDDWaterSampling	Samp_Depth_Units	10	20	Sampling Depth Units
EDDWaterSampling	Samp_Concentration	10	20	Sample Concentration (low, medium, high)
EDDWaterSampling	Sampler	10	30	Sampler Name
EDDWaterSampling	Witness	10	30	Witness Name
EDDWaterSampling	LinkSampleNo	10	25	Linked Sample Number
EDDWaterSampling	Image_Path	10	100	Image File Path to an image file
EDDWaterSampling	Remarks	10	250	Remarks
EDDWaterSampling	Task_ID	10	4	System Field: Task_ID (FK)
EDDWaterSampling	Color	10	25	Sample Color
EDDWaterSampling	Odor	10	15	Sample Data
EDDWaterSampling	Temp	7	8	Water Quality Measurement
EDDWaterSampling	pH	7	8	Water Quality Measurement
EDDWaterSampling	Diss_O2	7	8	Water Quality Measurement

Table Name	Field Name	Type	Size	Description
EDDWaterSampling	Conductivity	7	8	Water Quality Measurement
EDDWaterSampling	ORP	7	8	Water Quality Measurement
EDDWaterSampling	Salinity	7	8	Water Quality Measurement
EDDWaterSampling	Turbidity	7	8	Water Quality Measurement
EDDWaterSampling	ConductUnits	10	15	Water Quality Measurement
EDDWaterSampling	Diss02Units	10	15	Water Quality Measurement
EDDWaterSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDWaterSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDWaterSampling	COC	10	30	Chain of Custody Number (FK)
EDDWaterSampling	Coll_Method	10	30	Collection Method
EDDWaterSampling	Container	10	30	Sample Container
EDDWaterSampling	No_Container	7	8	Number of Sample Containers
EDDWaterSampling	Storage	10	30	Sample Storage
EDDWaterSampling	Preservation	10	30	Sample Preservation
EDDWaterSampling	Analyses	10	64	Lab Analyses for this sample (i.e. VOCs) (FK)
EDDWaterSampling	Tag_Matrix	10	20	Tag Matrix
EDDWaterSampling	Tag_Measurement	7	8	Tag Measurement
EDDWaterSampling	Tag_Units	10	20	Tag Units of measurement
EDDWaterSampling	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)
EDDWaterSampling	Description	10	30	Sample Analyses Description
EDDWaterSampling	PropertyID	10	50	Property ID (FK)
EDDWaterSampling	LocationDescription	10	100	Location Description
EDDWaterSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDWaterSampling	Latitude	7	8	Latitude
EDDWaterSampling	Longitude	7	8	Longitude
EDDWaterSampling	Altitude	7	8	Altitude
EDDWaterSampling	Northing	7	8	Northing
EDDWaterSampling	Easting	7	8	Easting

Table Name	Field Name	Type	Size	Description
EDDWaterSampling	Datum	10	50	Datum of the station coordinates
EDDWaterSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. (i.e. GPS, Interpolation, Survey)
EDDWaterSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDWaterSampling	Surf_Elev	7	8	Surface Elevevation
EDDWaterSampling	Surf_Units	10	20	Surface Elevevation Units
EDDWaterSampling	ElevMethod	10	60	Method used to determine the elevation measurement. (i.e. Altimetry, GPS, Interpolation, Other, Survey)
EDDWaterSampling	ElevDatum	10	50	Datum used to determine the elevation measurement (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
EDDWaterSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system. (i.e UTM NAD83)
EDDWaterSampling	LocationComment	10	250	Location Comment
EDDWaterSampling	Location_Image_Path	10	255	Location Image Path to related image file.
EDDWaterSampling	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDWaterSampling	Preliminary_Results	1	1	
EDDWaterSampling	Tared_Weight	7	8	
EDDWaterSampling	Final_Weight	7	8	

Table Name	Field Name	Type	Size	Description
EDDWaterSampling	Sample_Weight	7	8	
EDDWaterSampling	Depth_To_Water	7	8	
EDDWaterSampling	Depth_To_Water_Units	10	25	
EDDWaterSampling	TAT	7	8	
EDDWaterSampling	TAT_Units	10	25	
EDDWipeSampling	RecordId	4	4	System field
EDDWipeSampling	UnitID	4	4	System field
EDDWipeSampling	UserName	10	255	System field
EDDWipeSampling	TimeStamp	8	8	System field
EDDWipeSampling	SampleCounter	7	8	System field
EDDWipeSampling	Site_No	10	12	Site Number (Required)
EDDWipeSampling	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (Required)
EDDWipeSampling	EventID	10	50	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC, Site Assessment)
EDDWipeSampling	Location	10	50	Sampling Location Code (Required)
EDDWipeSampling	Sub_Location	10	25	Sub Location further describe Location info
EDDWipeSampling	SampleDate	8	8	Date Sample Taken
EDDWipeSampling	SampleTime	10	5	Time Sample Taken (hh:mm)
EDDWipeSampling	SampleType	10	30	Sample Type (i.e., Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
EDDWipeSampling	Activity	10	50	Sampling Activity
EDDWipeSampling	Matrix	10	40	Sample Matrix (i.e., Wipe)
EDDWipeSampling	SampleMedia	10	30	Sampling Media (i.e., Gauze pad)
EDDWipeSampling	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
EDDWipeSampling	Volume	7	8	Wipe Sampling Area.
EDDWipeSampling	Volume_Units	10	20	Wipe Area Units
EDDWipeSampling	Samp_Concentration	10	20	low, medium, high

Table Name	Field Name	Type	Size	Description
EDDWipeSampling	Sampler	10	30	Sampler Name
EDDWipeSampling	Witness	10	30	Witness Name
EDDWipeSampling	LinkSampleNo	10	25	Linked Sample Number
EDDWipeSampling	Image_Path	10	100	Image File Path to related image file
EDDWipeSampling	Remarks	10	250	Remarks
EDDWipeSampling	Task_ID	10	4	Scribe System Task_ID (FK)
EDDWipeSampling	Composite_Discrete	10	10	i.e., Composite or Discrete
EDDWipeSampling	Area1	7	8	Measurement
EDDWipeSampling	Area2	7	8	Measurement
EDDWipeSampling	Area_Surface	10	50	Area Surface
EDDWipeSampling	Dust_PumpID	10	50	
EDDWipeSampling	Dust_Start_Date	8	8	
EDDWipeSampling	Dust_Start_Time	8	8	
EDDWipeSampling	Dust_Stop_Date	8	8	
EDDWipeSampling	Dust_Stop_Time	8	8	
EDDWipeSampling	Dust_Time_Counter	10	10	
EDDWipeSampling	Dust_Start_Count	7	8	
EDDWipeSampling	Dust_Stop_Count	7	8	
EDDWipeSampling	Dust_Total_Time	7	8	
EDDWipeSampling	Dust_Pre_Cal	7	8	Start Flow Rate
EDDWipeSampling	Dust_Post_Cal	7	8	Stop Flow Rate
EDDWipeSampling	Dust_Avg_Flow	7	8	
EDDWipeSampling	Dust_Flow_Units	10	20	
EDDWipeSampling	Dust_Pump_Fault	10	1	
EDDWipeSampling	Tag	10	15	Samples Tag (Required. Defaults to A)
EDDWipeSampling	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
EDDWipeSampling	COC	10	30	Chain of Custody Number (FK)
EDDWipeSampling	Coll_Method	10	30	Collection Method

Table Name	Field Name	Type	Size	Description
EDDWipeSampling	Container	10	30	Sample Container
EDDWipeSampling	No_Container	7	8	Number of Sample Containers
EDDWipeSampling	Storage	10	30	Sample Storage
EDDWipeSampling	Preservation	10	30	Sample Preservation
EDDWipeSampling	Analyses	10	64	Lab Analyses (i.e., VOCs) (FK)
EDDWipeSampling	Tag_Matrix	10	20	Tag Matrix
EDDWipeSampling	Tag_Measurement	7	8	Tag Measurement - i.e. Tag Weight
EDDWipeSampling	Tag_Units	10	20	Tag Units i.e. units of measurement
EDDWipeSampling	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)
EDDWipeSampling	Description	10	30	Sample Analyses Description
EDDWipeSampling	PropertyID	10	50	Property Id (FK)
EDDWipeSampling	LocationDescription	10	100	Location Description
EDDWipeSampling	LocationZone	10	25	Describes the area impacted relative to the site
EDDWipeSampling	Latitude	7	8	Latitude
EDDWipeSampling	Longitude	7	8	Longitude
EDDWipeSampling	Altitude	7	8	Altitude
EDDWipeSampling	Northing	7	8	Northing
EDDWipeSampling	Easting	7	8	Easting
EDDWipeSampling	Datum	10	50	Datum of the station coordinates
EDDWipeSampling	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. (i.e.: GPS, Interpolation, Survey)
EDDWipeSampling	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
EDDWipeSampling	Surf_Elev	7	8	Surface Elevation
EDDWipeSampling	Surf_Units	10	20	Surface Elevation Units
EDDWipeSampling	ElevMethod	10	60	Method used to determine the elevation measurement. (i.e. Altimetry, GPS, Interpolation, Other, Survey)

Table Name	Field Name	Type	Size	Description
EDDWipeSampling	ElevDatum	10	50	Datum used to determine the elevation measurement. (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
EDDWipeSampling	Coord_Sys_Desc	10	70	Sampling location coordinate system. (i.e., UTM NAD83)
EDDWipeSampling	LocationComment	10	250	Location Comment
EDDWipeSampling	Location_Image_Path	10	255	Location Image Path to related image file.
EDDWipeSampling	Imported	10	1	System field. N = Has Not been imported. Y = Has been imported into a Scribe project
EDDWipeSampling	Preliminary_Results	1	1	
EDDWipeSampling	Tared_Weight	7	8	
EDDWipeSampling	Final_Weight	7	8	
EDDWipeSampling	Sample_Weight	7	8	
EDDWipeSampling	TAT	7	8	
EDDWipeSampling	TAT_Units	10	25	
Events	EventsID	4	4	Database AutoNumber
Events	Site_No	10	12	Site Number (PK, FK)
Events	EventID	10	50	EventID. Use to group data by sampling/monitoring events (i.e. EOC, Site Assessment) (PK)
Events	EventDate	8	8	Event Date
Events	EventTime	8	8	Event Time
Events	CtrContact	10	30	

Table Name	Field Name	Type	Size	Description
Events	Option_Period	10	5	
Events	CTRWano	10	25	
Events	AmbTemp	10	10	
Events	RelHumidity	10	10	
Events	BarPressure	10	10	
Events	Temperature	10	10	
Events	WindSpeed	10	10	
Events	WindDir	10	20	
Events	Precip	10	10	
Events	Sky	10	15	
Events	EventRemarks	10	255	
Events	Date_Input	8	8	System Date Input
Events	Date_Edit	8	8	System Date Edit
Events	Edited_By	10	20	System Edited By
Instruments	InstrumentsDBID	4	4	Database AutoNumber
Instruments	Site_No	10	12	Site Number (PK, FK)
Instruments	InstrumentID	10	50	Instrument ID. Uniquely identifies instrument (PK)
Instruments	Instrument_Descr	10	100	Instrument Description (i.e. Photo Ion Detector, HNU)
Instruments	Instrument_SN	10	50	Instrument SN (i.e. A11198)
Instruments	Instrument_Manufacturer	10	50	Instrument Manufacturer (i.e. HNU Systems)
Instruments	Instrument_Model	10	50	Instrument Model (i.e. ISPI-101)
Instruments	Instrument_Type	10	50	Instrument Type (i.e. PID/FID)
Instruments	Instrument_Cal_Date	8	8	Instrument Calibration Date
Instruments	Instrument_Cal_By	10	50	Instrument Calibrated By
Instruments	Instrument_Cal_Isotope	10	50	Instrument Calibration Isotope
Instruments	Instrument_Efficiency	10	50	Instrument Efficiency
Instruments	Instrument_Ref_Cal_Point	10	50	Instrument Ref Cal Point
Instruments	Instrument_Remark	10	255	Instrument Remark

Table Name	Field Name	Type	Size	Description
Instruments	Detector_ID	10	50	Detector ID
Instruments	Detector_Type	10	50	Detector Type
Instruments	Detector_Mode	10	50	Detector Mode
LabAnalyses	LabAnalysesID	4	4	Database AutoNumber
LabAnalyses	Site_No	10	12	Site Number (PK, FK)
LabAnalyses	Analyses_Type	10	20	Analyses Type (i.e. Organics, Inorganics, Generic, Default, Other)
LabAnalyses	Program_Type	10	10	The Program (i.e. CLP or Non-CLP)
LabAnalyses	Analyses_ID	10	4	System field
LabAnalyses	Analyses	10	50	Analysis Name (i.e., VOCs, PCBs, metals TAL) (PK)
LabAnalyses	Analyses_Abbrev	10	20	Analyses Abbrev
LabAnalyses	Turnaround	7	8	Turnaround time for the analysis
LabAnalyses	Turnaround_Units	10	25	Turnaround time units for the analysis (i.e. Days, Hours)
LabAnalyses	LabQCType	10	50	Lab QC to be done on the analysis
LabAnalyses	Analytical_Method	10	100	Analytical Method
LabAnalyses	Analyses_Comment	10	100	Analyses Comment
LabAnalyses	Analyses_Container	10	30	
LabAnalyses	Analyses_Preservation	10	30	
LabResults	LabResultsID	4	4	Table Autonumber. Site_No,Samp_No, Analysis, Analyte, Result_Units
LabResults	Site_No	10	12	Site Number (Required PK, FK)
LabResults	Samp_No	10	50	Scribe/Field Sample Number (Required PK, FK)
LabResults	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
LabResults	Lab_Location_ID	10	50	Sample Location ID reported by the lab
LabResults	Matrix_ID	10	20	Matrix ID reported by Lab. (i.e. Soil, Water, Air, etc.)

Table Name	Field Name	Type	Size	Description
LabResults	Sample_Type_Code	10	50	Code which distinguishes between different types of samples. For example normal samples must be distinguished from lab method blank samples
LabResults	Lab_Coc_No	10	50	Chain of Custody Number as reported by the Lab
LabResults	Date_Collected	8	8	Date Sample Collected as reported by the Lab
LabResults	Date_Received	8	8	Date Samples Received by Lab
LabResults	Date_Extracted	8	8	Date Samples Extracted by Lab
LabResults	Date_Analyzed	8	8	Date Analysis was performed by Lab
LabResults	Lab_Name	10	50	Laboratory that performed the analysis
LabResults	Lab_Samp_No	10	25	Lab Sample Number
LabResults	Lab_Batch_No	10	30	Lab Batch Number
LabResults	Analysis	10	100	Lab Analysis (i.e., VOCs) (Required PK)
LabResults	Analytical_Method	10	100	Lab Analytical Method (i.e. 8270M)
LabResults	Extraction_Method	10	100	Lab Extraction Method (i.e. MEP, TCLP, SPLP, EP)
LabResults	CAS_NO	10	50	Chemical Abstract Number (CAS)
LabResults	Analyte	10	60	Analyte/Parameter name (i.e., Lead, Arsenic, etc.) (Required PK, FK)
LabResults	Detected	10	20	Detected or Not Detected. i.e. "Y" for detected analytes or "N" for non_detects.
LabResults	Result	7	8	Result (number) returned from lab
LabResults	Result_Qualifier	10	10	Final/Validated Result qualifier/flag (i.e. J,U,ND,<,>)
LabResults	Lab_Result_Qualifier	10	10	Result Qualifier as Reported by the Lab
LabResults	Result_Units	10	20	Result Unit of measurement (Required PK)
LabResults	MDL	7	8	Method Detection Limit (MDL)
LabResults	MDL_Units	10	20	MDL Units
LabResults	Quantitation_Limit	7	8	Quantitation Limits as determined by the lab.
LabResults	Quantitation_Limit_Units	10	20	Quantitation Limit Units
LabResults	Reporting_Limit	7	8	Reporting Limits as determined by the lab.

Table Name	Field Name	Type	Size	Description
LabResults	Reporting_Limit_Units	10	20	Reporting Limit Units
LabResults	Reportable_Result	10	5	"Yes" for results which are considered to be reportable, or "No" for other results
LabResults	Result_Type_Code	10	50	"TRG" for a target or regular result, "TIC" for tentatively identifed compounds, "SUR" for surrogates, "IS" for internal standards, or "SC" for spiked compounds.
LabResults	QC_Type	10	40	Laboratory_Control_Sample, Method_Blank
LabResults	Percent_Solids	7	8	Percent Solids
LabResults	Percent_Lipids	7	8	Percent Lipids
LabResults	Percent_Moisture	7	8	Percent Moisture of the sample portion used in the test
LabResults	Total_Or_Disolved	10	30	"D" for dissolved or filtered (metal) concentration, or "T" for everything else
LabResults	Test_Type	10	30	Type of test (i.e. "initial", "reextract1", "reextract2", "reextract3", "reanalysis", "dilution1", "dilution2", and "dilution3")
LabResults	Basis	10	10	"Wet" for wet_weight basis reporting, "Dry" for dry_weight reporting
LabResults	Dilution_Factor	7	8	Effective test dilution factor.
LabResults	Percent_Recovery	7	8	Percent Recovery
LabResults	SubSample_Amount	7	8	Amount of sample used for test.
LabResults	SubSample_Amount_Unit	10	20	Unit of measurement for subsample amount.
LabResults	Final_Volume	7	8	The final volume of the sample after sample preparation. Include all dilution factors.
LabResults	Final_Volume_Unit	10	20	The unit of measurement that corresponds to the final_amount.
LabResults	Comments	10	250	Result Comments
LabResults	QAFlag	4	4	QAFlag (Values: 0 = Not QAed 1=QAed)

Table Name	Field Name	Type	Size	Description
LabResults	QA_Date	8	8	QA Date
LabResults	QA_Comment	10	250	QA Comment
LabResults	QA_UserName	10	50	QA Username
LabResults	Date_Input	8	8	System Date Input
LabResults	Date_Edit	8	8	System Date Edit
LabResults	Edited_By	10	20	System Edited By
LabResults	EDD_File_Name	10	100	
LabResults	Validation_Level	10	30	
Location	LocationID	4	4	Database AutoNumber
Location	Site_No	10	12	Site Number (PK, FK)
Location	Location	10	50	Sampling Location Code/Monitoring Location Code (PK)
Location	PropertyID	10	50	Property ID (FK)
Location	LocationDescription	10	100	Location Description further describes the Location Code.
Location	LocationZone	10	25	Location Zone describes the area impacted relative to the site.
Location	Latitude	7	8	Latitude
Location	Longitude	7	8	Longitude
Location	Altitude	7	8	Altitude
Location	GPS_PDOP	7	8	Position Dilution of Precision
Location	GPS_CorrectionType	10	50	GPS Correction Type (i.e. uncorrected, corrected)
Location	GPS_Date	8	8	GPS Date Recorded
Location	GPS_Time	8	8	GPS Time Recorded
Location	GPS_Collected_By	10	30	Collector of GPS Data
Location	GPS_Comment	10	50	GPS comment recorded
Location	GPS_Phase	10	30	Phase that GPS coordinate was captured.
Location	Northing	7	8	Northing
Location	Easting	7	8	Easting

Table Name	Field Name	Type	Size	Description
Location	Datum	10	50	Geopositioning datum associated with the Latitude and Longitude coordinates. (i.e. NAD27, NAD83)
Location	GeoMethod	10	60	Geopositioning method used to establish Latitude and Longitude coordinates. (i.e. GPS, Interpolation, Survey)
Location	GeoScale	10	20	Scale of the map or photo used to interpolate the Latitude and Longitude coordinates
Location	Surf_Elev	7	8	Surface Elevation records the Ground elevation of a geographic point where samples or field measurements are collected.
Location	Surf_Units	10	20	Surface Elevation Units (i.e. feet, meters)
Location	ElevMethod	10	60	Method used to determine the elevation measurement. (i.e., Altimetry, GPS, Interpolation, Other, Survey)
Location	ElevDatum	10	50	Datum used to determine the elevation measurement. (i.e., NAVD88, NGVD29, WGS84, Sea Level, Unknown) Datum used to determine the elevation measurement Datum used to determine the elevation measurement. i.e. NAVD88, NGVD29, WGS84, Sea Level, Unknown
Location	Coord_Sys_Desc	10	70	Coordinate system
Location	LocationComment	10	250	Location Comment
Location	Location_Image_Path	10	255	File path to a related file or image
Location	Date_Input	8	8	System Date Input
Location	Date_Edit	8	8	System Date Edited

Table Name	Field Name	Type	Size	Description
Monitoring	MonitoringDBID	4	4	Database AutoNumber. The Scribe Import Wizard uses the Site_No, InstrumentID, Location, Mon_Date, Mon_Time, Mon_Parameter fields to uniquely identify monitoring records
Monitoring	Site_No	10	12	Site Number. (FK)
Monitoring	EventID	10	50	EventID. Use to group data by monitoring events. (FK)
Monitoring	InstrumentID	10	50	Instrument ID (FK)
Monitoring	Location	10	50	Monitoring Location Code (FK)
Monitoring	Sub_Location	10	30	Sub Location (i.e. Fence Line, Perimeter. For residential: Living Room, Kitchen, etc.)
Monitoring	Activity	10	50	Monitoring Activity
Monitoring	Mon_Date	8	8	Monitoring Date
Monitoring	Mon_Time	10	30	Monitoring Time (hh:mm:ss)
Monitoring	Mon_Operator	10	50	Monitoring/Sampler Name
Monitoring	Mon_Parameter	10	50	Monitoring Parameter (i.e. Mercury)
Monitoring	Mon_Measurement	7	8	Monitoring Measurement
Monitoring	Mon_Meas_Units	10	40	Monitoring Measurement Units
Monitoring	Mon_Qualifier	10	10	Monitoring data qualifier/flag (i.e. J,U,ND,<,>)
Monitoring	Mon_Criteria	7	8	Monitoring Criteria such as detection limit, action limit or other criteria
Monitoring	Mon_Criteria_Units	10	20	Monitoring Criteria Units
Monitoring	Mon_Source	10	50	Monitoring Source (i.e. Radiation Type/Energy)
Monitoring	Mon_Meas_Surface	10	50	Monitoring Measurement Surface (i.e. concrete)
Monitoring	Mon_Remark	10	255	Monitoring Data Remark
Monitoring	EDD_File_Name	10	100	
PropertyInfo	PropertyInfoDBID	4	4	Database AutoNumber
PropertyInfo	Site_No	10	12	Site Number (PK, FK)
PropertyInfo	PropertyID	10	50	PropertyID (PK)

Table Name	Field Name	Type	Size	Description
PropertyInfo	PropertyType	10	15	Property Type (i.e. residential)
PropertyInfo	PropertyAccessAgreement	1	1	Access Agreement Yes/No
PropertyInfo	OwnerOccupied	1	1	Owner Occupied Yes/No
PropertyInfo	TennantOccupied	1	1	Tenant Occupied Yes/No
PropertyInfo	PropertyZone	10	25	Property Zone
PropertyInfo	PropertyTaxID	10	50	Property Tax ID
PropertyInfo	PropertyBlockID	10	25	Property Block Number
PropertyInfo	PropertyParcelID	10	25	Parcel Identifier
PropertyInfo	PropertyFirstName	10	50	Property Contact's First Name
PropertyInfo	PropertyLastName	10	50	Property Contact's Last Name (Tenant)
PropertyInfo	PropertyPhone	10	50	Property Phone Number
PropertyInfo	PropertyAddress	10	50	Property Address
PropertyInfo	PropertyAddress2	10	50	Property Address 2
PropertyInfo	PropertyCity	10	50	Property City
PropertyInfo	PropertyState	10	20	Property State
PropertyInfo	PropertyZip	10	20	Property Zip
PropertyInfo	OwnerLastName	10	50	Owner Last Name
PropertyInfo	OwnerFirstName	10	50	Owner First Name
PropertyInfo	OwnerAddress	10	50	Owner Address (may be different than property address)
PropertyInfo	OwnerAddress2	10	50	Owner Address 2
PropertyInfo	OwnerCity	10	50	Owner City
PropertyInfo	OwnerState	10	20	Owner State
PropertyInfo	OwnerZip	10	20	Owner Zip
PropertyInfo	OwnerPhone	10	50	Owner Phone
PropertyInfo	OwnerAlternateNumber	10	50	Alternate Phone #
PropertyInfo	PropertyAccessRequestedDate	8	8	Access Requested Date
PropertyInfo	PropertyAccessApprovedDate	8	8	Access Approved Date

Table Name	Field Name	Type	Size	Description
PropertyInfo	PropertyDate1	8	8	DateExteriorAccessRequested
PropertyInfo	PropertyDate2	8	8	DateInteriorAccessRequested
PropertyInfo	PropertyDate3	8	8	DateInteriorAccessApproved
PropertyInfo	PropertyDate4	8	8	DateInteriorAccessDenied
PropertyInfo	PropertyDate5	8	8	DateExteriorAccessApproved
PropertyInfo	PropertyDate6	8	8	DateExteriorAccessDenied
PropertyInfo	PropertyX	7	8	X Coordinate
PropertyInfo	PropertyY	7	8	Y Coordinate
PropertyInfo	PropertyComment	10	250	Property Comment
PropertyOccupant	PropertyOccupantDBID	4	4	Database AutoNumber
PropertyOccupant	Site_No	10	12	Site Number (PK, FK)
PropertyOccupant	PropertyID	10	50	Property ID (FK)
PropertyOccupant	OccupantID	10	25	Occupant ID is a Unique Identifier for the occupant (PK)
PropertyOccupant	OccupantLastName	10	50	Last Name
PropertyOccupant	OccupantFirstName	10	50	First Name
PropertyOccupant	OccupantAge	7	8	Age
PropertyOccupant	OccupantAgeUnits	10	30	Occupant Age Units (i.e., years)
PropertyOccupant	OccupantGender	10	30	Gender
PropertyOccupant	OccupantDateContacted	8	8	Date Contacted
PropertyOccupant	OccupantRemarks	10	255	Remarks
refAnalytes	AnalytesDBID	4	4	
refAnalytes	Site_No	10	12	
refAnalytes	CAS_NO	10	50	
refAnalytes	Analyte	10	60	
refAnalytes	Chemical_Category	10	50	
refAnalytes	Chemical_ActionLevel	7	8	
refAnalytes	Chemical_ScreeningLevel	7	8	
refAnalytes	Chemical_Units	10	50	

Table Name	Field Name	Type	Size	Description
refLabLst	LabLstDBID	4	4	
refLabLst	Lab	10	50	
refLabLst	Lab_Contact	10	30	
refLabLst	Lab_Phone	10	20	
refLabLst	Lab_Fax	10	20	
refLabLst	Lab_Address	10	150	
refLabLst	Lab_Address2	10	50	
refLabLst	Lab_City	10	40	
refLabLst	Lab_State	10	20	
refLabLst	Lab_Zip	10	20	
refLabLst	Lab_Remark	10	250	
refMatrixLst	MatrixLstDBID	4	4	
refMatrixLst	Site_No	10	12	
refMatrixLst	Matrix	10	40	
refMatrixLst	Matrix_Code	10	10	
refMatrixLst	Matrix_Description	10	50	
refNames	NameID	4	4	
refNames	Site_No	10	12	
refNames	Name	10	30	
refPickLst	PickLstID	4	4	
refPickLst	Code	10	25	Pick List Category Code
refPickLst	Sort_Order	4	4	
refPickLst	Item_Code	10	5	Abbrev.
refPickLst	Item	10	30	Pick List Item Data
refPickLst	Item_Descr	10	30	
refPickLst	Item_Descr1	10	30	
refPickLst	Code_Used	10	1	Y = CODE FIELD USED
refPickLst	Approved	1	1	

Table Name	Field Name	Type	Size	Description
refSGenus	SGenusID	4	4	
refSGenus	Genus	10	40	Small Mammals Genus
refSGenus	Species	10	40	
refSGenus	ComName	10	40	
Samples	SamplesID	4	4	Database AutoNumber
Samples	Site_No	10	12	Site Number (PK, FK)
Samples	EventID	10	50	EventID. Use to group data by sampling/monitoring events (FK). For example, EOC, Site Assessment
Samples	Samp_No	10	50	Sample Number. Unique sample number (PK)
Samples	SampleDate	8	8	Date Sample Taken
Samples	SampleTime	10	5	Time Sample Taken
Samples	Location	10	50	Sample Location Cod/Station ID. Identifies where a sample was taken. (FK)
Samples	Sub_Location	10	25	Sub Location further describes Location info. (i.e. For residential: Living Room, Kitchen, etc.)
Samples	Matrix	10	40	Sampling Matrix (i.e. Water, Soil, Air)
Samples	SampleMedia	10	30	Sampling Media
Samples	SampleCollection	10	30	Sample Collection Method (i.e. Grab, Composite, Discrete Interval)
Samples	SampleType	10	30	Sample Type (i.e. Field Sample, Field Duplicate, Lab QC, Spike, Trip Blank)
Samples	Activity	10	50	Sampling Activity
Samples	Samp_Depth	7	8	Sampling Depth From
Samples	Samp_Depth_To	7	8	Sampling Depth To
Samples	Samp_Depth_Units	10	20	Sampling Depth Units
Samples	Volume	7	8	Air Sampling Volume. Wipe Sampling Area
Samples	Volume_Units	10	20	Volume Units
Samples	Samp_Concentration	10	20	Sample Concentration (low, medium, high)

Table Name	Field Name	Type	Size	Description
Samples	Sampler	10	30	Sampler Name/Organization
Samples	Witness	10	30	Witness Name/Organization
Samples	LinkSampleNo	10	25	Linked Sample Number
Samples	Image_Path	10	100	Image File Path
Samples	Remarks	12	0	Sample Remarks
Samples	LabResultsAvailable	1	1	System Assigned LabResults for this Sample Y/N
Samples	Task_ID	10	4	System Assigned Task_ID (Values: A01=Air Sampling, B01=Biota Sampling, SO01=Soil Sampling, SG01=Soil Gas Sampling, WA01=Water Sampling, WIPE=Wipe Sampling) (FK)
Samples	Date_Input	8	8	System Date Input
Samples	Date_Edit	8	8	System Date Edit
Samples	Edited_By	10	20	System Edited By
SamplesAir	SamplesAirID	4	4	Database AutoNumber
SamplesAir	Site_No	10	12	Site Number (PK, FK)
SamplesAir	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)
SamplesAir	SamplerID	10	50	Air Sampler Equipment ID - Pump #
SamplesAir	Date_Cal	8	8	Date Sampler Calibrated
SamplesAir	Media_Type	10	30	Air High Vol Sampling
SamplesAir	Media_Items	10	50	Air High Vol Sampling
SamplesAir	Start_Date	8	8	Air Sampling Start Date
SamplesAir	Start_Time	8	8	Air Sampler Start time (hh:mm)
SamplesAir	Stop_Date	8	8	Air Sampling Stop Date
SamplesAir	Stop_Time	8	8	Air Sampler Stop time (hh:mm)
SamplesAir	Time_Counter	10	10	Use Sampling Time or Sampler Counter to calculate time. (Values: Counter, Time)
SamplesAir	Start_Count	7	8	Air Sampler Start Counter
SamplesAir	Stop_Count	7	8	Air Sampler Stop Counter

Table Name	Field Name	Type	Size	Description
SamplesAir	Total_Time	7	8	Total Sampling time
SamplesAir	Start_Temperature	7	8	Start_Temperature (F)
SamplesAir	Start_Pressure	7	8	Start_Pressure (Hg)
SamplesAir	Stop_Temperature	7	8	Stop Temperature
SamplesAir	Stop_Pressure	7	8	Stop Pressure
SamplesAir	Pre_Magnehelic	7	8	Starting Magnehelic reading
SamplesAir	Post_Magnehelic	7	8	Ending Magnehelic reading
SamplesAir	Pre_Cal	7	8	Start Flow Rate - Pre-Calc
SamplesAir	Post_Cal	7	8	Stop Flow Rate - Post-Calc
SamplesAir	Avg_Flow	7	8	Average Flow Rate
SamplesAir	Flow_Units	10	20	Flow rate Units (i.e. Liters)
SamplesAir	Pump_Fault	10	1	Pump Fault (Y,N)
SamplesAir	Orifice_ID	10	50	Orifice ID
SamplesBiota	SamplesBiotaID	4	4	Database AutoNumber
SamplesBiota	Site_No	10	12	Site Number (PK, FK)
SamplesBiota	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)
SamplesBiota	LiveDead	10	20	Sample Taken Alive or Dead! (Values: Live, Dead)
SamplesBiota	TrapType	10	20	Trap Type
SamplesBiota	WholePart	10	20	Whole or Partial Sample Taken
SamplesBiota	Maturity	10	20	Relative Age Class
SamplesBiota	FP	10	20	Values: Fresh or Preserved
SamplesBiota	Age	7	8	Age
SamplesBiota	AgedBy	10	20	Aged By Units
SamplesBiota	Genus	10	50	Genus
SamplesBiota	Species	10	50	Species
SamplesBiota	ComName	10	50	Common Name
SamplesBiota	Family	10	50	Family
SamplesBiota	SPCode	10	3	SPCode

Table Name	Field Name	Type	Size	Description
SamplesBiota	Sex	10	20	Male, Female
SamplesBiota	TotalLength	7	8	measurement
SamplesBiota	WholeWeight	7	8	measurement
SamplesBiota	TailLength	7	8	measurement
SamplesBiota	HindFootLength	7	8	measurement
SamplesBiota	EarLength	7	8	measurement
SamplesBiota	ForkLength	7	8	measurement
SamplesBiota	StandardLength	7	8	measurement
SamplesBiota	FiletWeight	7	8	measurement
SamplesMeasurements	SamplesMeasurementsID	4	4	Database AutoNumber
SamplesMeasurements	Site_No	10	12	Site Number (PK, FK)
SamplesMeasurements	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)
SamplesMeasurements	Meas_Descr	10	30	Measurement Description (PK)
SamplesMeasurements	Meas_Result	7	8	Measurement Result
SamplesMeasurements	Meas_Units	10	20	Measurement Units
SamplesMeasurements	Meas_Remark	10	50	Measurement Remark
SamplesSoil	SamplesSoilID	4	4	Database AutoNumber
SamplesSoil	Site_No	10	12	Site Number (PK, FK)
SamplesSoil	Samp_No	10	50	Sample Number. Scribe requires a unique sample number (PK, FK)
SamplesSoil	Color	10	25	Sample Color
SamplesSoil	Soil_Descr	10	25	Soil Description (i.e. Sandy/Silty/Clay)
SamplesSoil	Munsel_Y	10	30	Munsell Color Code
SamplesSoil	Munsel_R	10	30	Munsell Color Code
SamplesSoilGas	SamplesSoilGasID	4	4	Database AutoNumber
SamplesSoilGas	Site_No	10	12	Site Number (PK, FK)
SamplesSoilGas	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)

Table Name	Field Name	Type	Size	Description
SamplesSoilGas	Color	10	25	Sample Color
SamplesSoilGas	Soil_Descr	10	25	Soil Description (i.e. Sandy/Silty/Clay)
SamplesSoilGas	HNU	7	8	measurement
SamplesSoilGas	OVA	7	8	measurement
SamplesSoilGas	LEL	7	8	measurement
SamplesSoilGas	O2	7	8	measurement
SamplesSoilGas	Soil_Temp	7	8	measurement
SamplesSoilGas	Methane	7	8	measurement
SamplesSoilGas	Other1	7	8	measurement
SamplesSoilGas	Other2	7	8	measurement
SamplesTags	SamplesTagID	4	4	Database AutoNumber
SamplesTags	Site_No	10	12	Site Number (PK, FK)
SamplesTags	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)
SamplesTags	Tag	10	15	Sample Tag. Scribe UI defaults this to 'A' (PK, FK)
SamplesTags	CLP_Sample_No	10	25	CLP Sample Number for samples submitted to the CLP program.
SamplesTags	COC	10	30	Chain of Custody Number (FK)
SamplesTags	Coll_Method	10	30	TAG's Collection Method
SamplesTags	Container	10	30	Container
SamplesTags	No_Container	7	8	Number of Containers
SamplesTags	Storage	10	30	Sample Storage
SamplesTags	Preservation	10	30	Sample Preservation
SamplesTags	Analyses_IDD	10	4	System Field
SamplesTags	Analyses	10	50	Lab Analyses (FK)
SamplesTags	Tag_Matrix	10	20	Tag matrix
SamplesTags	Tag_Measurement	7	8	Tag Measurement - i.e. Tag Weight
SamplesTags	Tag_Units	10	20	Tag Units of measurement
SamplesTags	MS_MSD	10	1	Matrix Spike/Matrix Spike Duplicate (Y or N)

Table Name	Field Name	Type	Size	Description
SamplesTags	Description	10	30	Description
SamplesTags	Preliminary_Results	1	1	
SamplesTags	Tared_Weight	7	8	
SamplesTags	Final_Weight	7	8	
SamplesTags	Sample_Weight	7	8	
SamplesTags	TAT	7	8	
SamplesTags	TAT_Units	10	25	
SamplesWater	SamplesWaterID	4	4	Database AutoNumber
SamplesWater	Site_No	10	12	Site Number (PK, FK)
SamplesWater	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)
SamplesWater	Color	10	25	Water Quality
SamplesWater	Odor	10	15	Water Quality
SamplesWater	Temp	7	8	Water Quality Measurement
SamplesWater	pH	7	8	Water Quality Measurement
SamplesWater	Diss_O2	7	8	Water Quality Measurement
SamplesWater	Conductivity	7	8	Water Quality Measurement
SamplesWater	ORP	7	8	Water Quality Measurement
SamplesWater	Salinity	7	8	Water Quality Measurement
SamplesWater	Turbidity	7	8	Water Quality Measurement
SamplesWater	Container_No	10	15	Container Number(s)
SamplesWater	ConductUnits	10	15	Water Quality Measurement
SamplesWater	Diss02Units	10	15	Water Quality Measurement
SamplesWater	Depth_To_Water	7	8	
SamplesWater	Depth_To_Water_Units	10	25	
SamplesWipe	SamplesWipeID	4	4	Database AutoNumber
SamplesWipe	Site_No	10	12	Site Number (PK, FK)
SamplesWipe	Samp_No	10	50	Sample Number. Scribe requires a unique sample number. (PK, FK)

Table Name	Field Name	Type	Size	Description
SamplesWipe	Composite_Discrete	10	10	Composite or Discrete
SamplesWipe	Area1	7	8	Measurement
SamplesWipe	Area2	7	8	Measurement
SamplesWipe	Area_Surface	10	50	Area Surface
SamplesWipe	Dust_PumpID	10	50	
SamplesWipe	Dust_Start_Date	8	8	
SamplesWipe	Dust_Start_Time	8	8	
SamplesWipe	Dust_Stop_Date	8	8	
SamplesWipe	Dust_Stop_Time	8	8	
SamplesWipe	Dust_Time_Counter	10	10	
SamplesWipe	Dust_Start_Count	7	8	
SamplesWipe	Dust_Stop_Count	7	8	
SamplesWipe	Dust_Total_Time	7	8	
SamplesWipe	Dust_Pre_Cal	7	8	Start Flow Rate
SamplesWipe	Dust_Post_Cal	7	8	Stop Flow Rate
SamplesWipe	Dust_Avg_Flow	7	8	
SamplesWipe	Dust_Flow_Units	10	20	
SamplesWipe	Dust_Pump_Fault	10	1	
Site	SiteID	4	4	Database AutoNumber
Site	Site_No	10	12	Site Number (PK)
Site	Site_Numb	10	12	User assigned site number
Site	Option_Period	10	5	Contract Option Period
Site	Site_Name	10	50	Name of site or project
Site	Area	10	60	Area, location of site
Site	Site_State	10	20	Site State
Site	Site_Phone	10	30	Site Phone #
Site	Description	10	50	Site Description
Site	Site_Action	10	30	Site Action (i.e. Emergency, TC, NTC, Remedial)

Table Name	Field Name	Type	Size	Description
Site	DO_Number	10	30	Delivery Order Number
Site	CERCLIS	10	20	Cerclis Number
Site	AccountCode	10	50	Account Code
Site	ProjectCode	10	50	Default Regional Project Code
Site	Numeric_Tags	1	1	Calculate unique, numeric TAG numbers for analytical samples
Site	CaseNumber	10	5	CLP CaseNumber
Site	Next_CLP_Sample_No	10	50	Next CLP Sample No.
Site	Next_Tag	10	15	Next Tag No.
Site	Region_Tag_Prefix	1	1	Prefix Tags with the Region Number (i.e. 6-)
Site	Response_Authority	10	30	Response_Authority (i.e. OPA, CERCLA)
Site	NPL_Status	10	20	i.e. Non NPL
Site	DASNumber	10	50	DAS Number
Site	EPARegionNumber	10	10	EPA Region Number
Site	EPA_OrgName	10	50	EPA Organization (i.e., ERT)
Site	EPAContract_No	10	50	EPA Contract #
Site	EPAProj_No	10	50	EPA Project Number
Site	EPAContact	10	50	Primary EPA contact
Site	EPAPhone	10	50	Primary EPA contact phone #
Site	Contract_Name	10	50	Name of the contract (i.e. START)
Site	Contractor	10	50	Contractor name/company name
Site	CTRContact	10	50	Contractor Contact
Site	Address1	10	50	Contractor Address
Site	Address2	10	50	Contractor Address
Site	City	10	50	Contractor City
Site	State	10	20	Contractor State
Site	Zip	10	20	Contractor Zip
Site	CTRPhone	10	50	Contractor Phone
Site	CTRWano	10	50	Contractor WA #

Table Name	Field Name	Type	Size	Description
Site	Unit_Of_Meas	10	50	Unit Of Measurement (i.e., Metric or Imperial etc.)
Site	Remarks	12	0	Remarks
Site	Date_Input	8	8	System Generated Date Input
Site	Date_Edit	8	8	System Generated Date Edited
Site	Edited_By	10	20	system Generated User Login Name
Site	Control_No	10	30	Control # used by master database to track distributed data
Site	VER_NO	4	4	System DB VER_NO
Site	Template_File_Path	10	255	Scribe Template File (mdb) used to create the Scribe Project
Site	ScribeNetProjectID	4	4	
Site	ScribeNetCustomerID	4	4	
Site	CLP_Tag_Mask	10	50	
Site	Project_Default	10	20	
sysDataColumn	DataColumnID	4	4	Configuration Table
sysDataColumn	Site_No	10	12	
sysDataColumn	Task_ID	10	30	Task. i.e. SO01, A01, WA01
sysDataColumn	Task_Desc	10	100	Task Desc. i.e. Soil, Air, Water
sysDataColumn	View_ID	10	25	Grid View. i.e. grdone, grdtwo
sysDataColumn	DataColumn	10	100	Field Name
sysDataColumn	LayoutName	10	50	
sysDataColumn	DefaultCaption	10	100	
sysDataColumn	CustomCaption	10	100	
sysDataColumn	Visible	1	1	
sysDataColumn	Locked	1	1	
sysDataColumn	ColWidth	4	4	
sysDataColumn	ColOrder	4	4	
sysDataColumn	ColAlignment	4	4	0=left, 1=center, 2=right, 3=general
sysDataColumn	Required	1	1	Required Field

Table Name	Field Name	Type	Size	Description
sysDataColumn	CanSort	1	1	Can Sort on Column
sysDataColumn	CanFind	1	1	Can Find on Column
sysDataColumn	CanCopy	1	1	Column can be copied
sysDataColumn	LookupLstID	10	50	Lookup List ID for the column. If not defined, Scribe assigns system default lookup List IDs for the data column. FK ->sysLookupLst
sysDataColumn	DisableLookupLst	1	1	Disable grid lookup lists for the column
sysDataColumnLayout	DataColumnLayoutID	4	4	
sysDataColumnLayout	Site_No	10	12	
sysDataColumnLayout	Task_ID	10	30	
sysDataColumnLayout	View_ID	10	25	
sysDataColumnLayout	LayoutName	10	50	
sysDataColumnLayout	ActiveLayout	1	1	
sysDataColumnLayout	SQLWhere	12	0	
sysDataColumnLayout	SQLOrderBy	12	0	
sysDataLabel	DataLabelID	4	4	
sysDataLabel	Site_No	10	12	
sysDataLabel	Task_ID	10	30	
sysDataLabel	View_ID	10	25	
sysDataLabel	LayoutName	10	50	
sysDataLabel	Number	4	4	
sysDataLabel	ID	10	50	
sysDataLabel	ItemAcrossPage	4	4	
sysDataLabel	TopMargin	7	8	
sysDataLabel	BottomMargin	7	8	
sysDataLabel	LeftMargin	7	8	
sysDataLabel	RightMargin	7	8	
sysDataLabel	dxSpace	7	8	
sysDataLabel	dySpace	7	8	

Table Name	Field Name	Type	Size	Description
sysDataLabel	LeftMarginInside	7	8	
sysDataLabel	TopMarginInside	7	8	
sysDataLabel	Width	7	8	
sysDataLabel	Height	7	8	
sysDataLabel	Continuous	1	1	
sysDataLabel	PortraitOrientation	1	1	
sysDataLabel	WordWrap	1	1	
sysDataLabel	Description	10	255	
sysDataLabelLines	DataLabelLinesID	4	4	
sysDataLabelLines	Site_No	10	12	
sysDataLabelLines	Task_ID	10	30	
sysDataLabelLines	View_ID	10	25	
sysDataLabelLines	Line_No	4	4	
sysDataLabelLines	LayoutName	10	50	
sysDataLabelLines	Value	10	150	
sysDataLabelLines	Alignment	3	2	
sysDataLabelLines	FontName	10	50	
sysDataLabelLines	FontSize	3	2	
sysDataLabelLines	FontBold	1	1	
sysDataLabelLines	FontItalic	1	1	
sysDataLabelLines	FontUnderline	1	1	
sysDataLabelLines	FontStrikeThru	1	1	
sysDataLabelLines	FontColor	4	4	
sysDataLabelLst	DataLabelID	4	4	
sysDataLabelLst	Number	4	4	
sysDataLabelLst	ID	10	50	
sysDataLabelLst	ItemAcrossPage	4	4	
sysDataLabelLst	TopMargin	7	8	

Table Name	Field Name	Type	Size	Description
sysDataLabelLst	BottomMargin	7	8	
sysDataLabelLst	LeftMargin	7	8	
sysDataLabelLst	RightMargin	7	8	
sysDataLabelLst	dxSpace	7	8	
sysDataLabelLst	dySpace	7	8	
sysDataLabelLst	LeftMarginInside	7	8	
sysDataLabelLst	TopMarginInside	7	8	
sysDataLabelLst	Width	7	8	
sysDataLabelLst	Height	7	8	
sysDataLabelLst	Continuous	1	1	
sysDataLabelLst	PortraitOrientation	1	1	
sysDataLabelLst	WordWrap	1	1	
sysDataLabelLst	Description	10	255	
sysDataLabelLst	Predefined	1	1	
sysDataLabelLst	Metric	1	1	
sysDataMap	DataMapID	4	4	Data Map Across table for Importing data into Scribe
sysDataMap	Site_No	10	12	Site Number (FK)
sysDataMap	Category	10	100	Category (i.e., GPS Data, Lab Results)
sysDataMap	DataMapName	10	50	DataMap Script Name. i.e. Default
sysDataMap	DataTable	10	255	Data Table to Import Data Into
sysDataMap	RI_DataTable	10	50	Referential Integrity Data Table. Related records MUST be in this table in order to Import Into DataTable
sysDataMap	ImportFileType	10	100	Import File Types Supported
sysDataMap	ImportWS	10	200	
sysDataMap	ImportGroup	10	50	ImportGroup
sysDataMap	TargetTables	10	255	Tables that the DataTable is mapped to
sysDataMap	Task_ID	10	11	Scribe Task_ID to map tables too

Table Name	Field Name	Type	Size	Description
sysDataMap	UniqueFieldsForImport	10	255	
sysDataMapCol	DataMapColID	4	4	
sysDataMapCol	Site_No	10	12	Site Number (PK, FK)
sysDataMapCol	Category	10	100	Category (PK, FK)
sysDataMapCol	DataMapName	10	50	DataMapName (PK, FK)
sysDataMapCol	DataTable	10	100	Table to Import Data to (PK)
sysDataMapCol	DataColumn	10	100	Column to Import Data to (PK)
sysDataMapCol	MapToDataColumn	10	100	Column Name of Data being imported
sysDataMapCol	IsPrimaryKey	1	1	Is Column a Primary Key/Required Field
sysDataMapCol	IsRequired	1	1	Is a Required Field
sysDataMapCol	DataType	4	4	ADO/MS Access Data Type of Column. Uses to validate type of data being imported
sysDataMapCol	DataSize	4	4	Size of Dat Type. i.e. Text 50 chars
sysDataMapCol	MapToColIndex	4	4	Column Index of col in the import file
sysDataMapCol	Description	10	255	
sysDataRpt	DataWSRptID	4	4	
sysDataRpt	Site_No	10	12	
sysDataRpt	RptType	10	50	
sysDataRpt	Header1	10	200	
sysDataRpt	Header2	10	200	
sysDataRpt	Header3	10	200	
sysDataRpt	Header4	10	200	
sysDataRpt	Header5	10	200	
sysDataRpt	Header6	10	200	
sysDataRpt	Header7	10	200	
sysDataRpt	Header8	10	200	
sysDataRpt	Header9	10	200	
sysDataRpt	Header10	10	200	

Table Name	Field Name	Type	Size	Description
sysDataRpt	Header11	10	200	
sysDataRpt	ColsPerPage	4	4	
sysDataRpt	RepeatTable	4	4	
sysDataRpt	Orientation	10	50	
sysDataRpt	FontName	10	50	
sysDataRpt	FontSize	4	4	
sysDataRpt	Alignment	4	4	
sysDataRpt	ReportAnalysis	1	1	
sysDataViews	DataViewID	4	4	
sysDataViews	Site_No	10	12	Site Number (PK, FK))
sysDataViews	DataViewName	10	250	Name of Data View (MS Access View/Query Name) (PK, FK)
sysDataViews	Category	10	50	i.e. Default, Scriblet
sysDataViews	SQL	10	255	If SQL here, run that instead of the MSAccess Command Text
sysDataViews	SQLInsert	10	255	If SQL, use that to add a new record instead of a recordset Addnew
sysDataViews	SQLInsertFind	10	255	After a Record is added, this SQL is run to put the record pointer on the new record
sysDataViews	DBFilePath	10	255	Path to the MDB. Blank if = Project path alls the file path to an MDB file like the Scriblets.mdb
sysDataViews	Active	10	1	Values: Y, N
sysDataViews	SortOrder	4	4	Sort Order
sysDataViews	CanAdd	1	1	Can Add Data to Data View
sysDataViews	CanEdit	1	1	Can Edit Data to Data View
sysDataViews	CanDelete	1	1	Can Delete Data from Data View
sysDataViews	CanCopy	1	1	Can Copy Data to Data View
sysDataViews	CustomTask	1	1	Custom Task
sysKMLMap	KMLMapDBID	4	4	

Table Name	Field Name	Type	Size	Description
sysKMLMap	Site_No	10	12	
sysKMLMap	Task_ID	10	30	
sysKMLMap	View_ID	10	25	
sysKMLMap	LayoutName	10	50	
sysKMLMap	LatitudeColumn	10	100	
sysKMLMap	LongitudeColumn	10	100	
sysKMLMap	CaptionColumn	10	100	
sysKMLMap	LayerColumn	10	100	
sysKMLMap	AltitudeColumn	10	100	
sysKMLMap	MaxAltitude	4	4	
sysKMLMap	AltitudeDistDirection	4	4	
sysKMLMapClass	KMLMapClassDBID	4	4	
sysKMLMapClass	Site_No	10	12	
sysKMLMapClass	Task_ID	10	30	
sysKMLMapClass	View_ID	10	25	
sysKMLMapClass	LayoutName	10	50	
sysKMLMapClass	DataColumn	10	100	
sysKMLMapClass	Operator	4	4	
sysKMLMapClass	Value1	10	255	
sysKMLMapClass	Value2	10	255	
sysKMLMapClass	Color	10	50	
sysLookupLst	LookupLstDBID	4	4	
sysLookupLst	Site_No	10	12	
sysLookupLst	LookupLstID	10	50	Lookup ID
sysLookupLst	LookupLstSQL	10	255	Lookup List SQL or Object Name. Must return a Column As [Item]
sysTableLst	TableLstID	4	4	
sysTableLst	Table	10	50	The name of the Table (PK, FK)
sysTableLst	Task	10	15	If related to a TASK, the task code (PK, FK)

Table Name	Field Name	Type	Size	Description
sysTableLst	ImportTable	1	1	If True, GateKeeper will Import this table
sysTableLst	ExportTable	1	1	If True, GateKeeper will Export this file
sysTableLst	SortOrder	7	8	When appending, the order in which tables insert
sysTableLst	Site_no	10	1	If Y, table is site specific
sysTableLst	Event	10	1	If Y, table has an EventID field
sysTableLst	Description	10	150	Description of the table
sysTableLst	Table_Version	3	2	Table Version #. Increment when table structure changes
sysTableLst	DB_Version	3	2	DB Version #. Increment when any table's structure changes.
sysTableLst	PrimaryKey	10	250	Table Unique/Primary Key. Used when a table's PK is an autonumber to define a Natural PK for SQL INSERTS and UPDATE statements
sysTaskGroups	TaskGroupID	4	4	
sysTaskGroups	Site_No	10	12	Site Number. (PK, FK)
sysTaskGroups	Task_Group	10	50	i.e. Sampling, Analytical
sysTaskGroups	Task_Group_Desc	10	255	i.e., Soil sampling, Water Sampling
sysTaskGroups	Active	10	1	Is the Task Active f
sysTaskGroups	SortOrder	4	4	Display sort Order for this task
sysTaskLst	TaskLstID	4	4	Default Task List
sysTaskLst	Task_Id	10	11	System Task ID i.e. SO01=Soil Sampling (PK)
sysTaskLst	Task_Desc	10	40	i.e., Soil sampling, Water Sampling
sysTaskLst	Active	10	1	Is the Task Active for this site
sysTaskLst	Main_Table	10	20	Main/Top Level Table for the Task - i.e. Water for Water Sampling
sysTaskLst	Matrix	10	10	Matrix of stuff being sampled
sysTaskLst	Task_Group	10	50	i.e. Sampling, Analytical
sysTaskLst	Category	10	50	i.e. Air, Soil, Water, COC
sysTaskLst	SortOrder	4	4	Display sort Order for this task

Table Name	Field Name	Type	Size	Description
sysTasks	TaskID	4	4	Table contains Site Specific Task List
sysTasks	Site_No	10	12	Site Number. (PK, FK)
sysTasks	Task_Id	10	11	System Task ID i.e. SO01=Soil Sampling (PK, FK)
sysTasks	Task_Group	10	50	i.e., Sampling, Analytical
sysTasks	Category	10	50	i.e., Air, Soil, Water
sysTasks	Task_Desc	10	40	i.e., Soil sampling, Water Sampling
sysTasks	Active	10	1	Is the Task Active f
sysTasks	Default	10	1	Default Task
sysTasks	SortOrder	4	4	Display sort Order for this task
sysTasks	Samp_No_Mask	10	50	Task specific sample number format mask. #=numeric incrementing portion of the number, i.e., XX-####-XX
sysTasks	Last_Samp_No	4	4	Stores last sample number assigned for a sampling task
sysTasks	Tag_Mask	10	50	

Page left blank intentionally.

Attachment 3 – Primary RM11E Project Historical Geospatial Data

Page left blank intentionally.

Table C.1-5 Portland Harbor Geospatial Datasets Maintained as Part of the RM11E Project

Geospatial Data Set Name	Source	Description	Use Constraints
DIFFERENCE_2018_2004	EPA Interim Portal	Bathymetric Difference between 2018 and 2004 survey years	Public Information
INFRASTRUCTURE_DocksandStructures	EPA Interim Portal	Docks and structures along the Willamette	Public Information
INFRASTRUCTURE_NAVIGATION_CHANNEL	EPA Interim Portal	Data compiled through the Navigational Coastal Databank Program to support users of coastal navigation data	Public Information
INFRASTRUCTURE_Railroads	EPA Interim Portal	Portland area railroads	Public Information
INFRASTRUCTURE_RiverEdge	EPA Interim Portal	Portland area river edges - polys	Public Information
INFRASTRUCTURE_Rivermiles	EPA Interim Portal	Willamette river miles 0 - 27	Public Information
INFRASTRUCTURE_RM_Tenths_line	EPA Interim Portal	Willamette river mile tenths 0 - 27	Public Information
INFRASTRUCTURE_Streets	EPA Interim Portal	For locating street addresses and for cartographic products requiring a street base map	Public Information
Match_Line	EPA Interim Portal	Unknown	Public Information
PORTLAND2018_10ftContours	EPA Interim Portal	Bathymetric contours, 10' intervals	Public Information
PORTLAND2018_2ftContours	EPA Interim Portal	Bathymetric contours, 2' intervals	Public Information

Geospatial Data Set Name	Source	Description	Use Constraints
PORTLAND2018_Survey	EPA Interim Portal	2018 bathymetric survey, occurred between Mar 6 and June 15	Public Information
PORTLAND2018_Survey_Hillshade	EPA Interim Portal	2018 bathymetric survey produced hillshade	Public Information
PRIOR_2004_corrected	EPA Interim Portal	An offset of -0.09 feet was applied to each data set using the "Raster Calculator" tool in ArcGIS to account for the adjustment of the surveys from older ellipsoid heights and geoid models to current, more accurate models	Public Information
AOPC_Boundaries_Aug2011.shp	Anchor QEA/Lower Willamette Group	Areas of Potential Concern, August 2011 displayed in Portland Harbor Feasbility Study, March 2012	Do not quote or cite.
TechnologyAssignment_SelectedRemedy	EPA Interim Portal	Cap, Dredge, EMNR, MNR, Outbound designated areas	Public Information
Breaklines	David Evans, and Associates (DEA)	Breaklines for the elevation model	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
MappingExtent_20140117	DEA	The extent of data included in the file geodatabase	None Identified
ModeledExtent_20140117	DEA	The extent used for the model	None Identified
NOAA_MBES_2009_Mapping_20140117	DEA	High resolution multibeam survey conducted for NOAA - converted to points	None Identified
RLIS_Buildings	Portland METRO	Area building footprints	None Identified
RM11E_Points_20140117	DEA	High resolution multibeam survey conducted for NOAA - converted to points	None Identified
RM11E_Terrain_MappingExtent_20140117	DEA	RM11E Terrain within the mapping extent of the project	None Identified
RM11E_Terrain_ModeledExtent_20140117	DEA	RM11E Terrain within the modeled extent of the project	None Identified
USACE_LIDAR_2009_Mapping_20140117	DEA /USACE	A high resolution LiDAR survey conducted by the United States Army Corps of Engineers	None Identified
RM11E_Map	DEA	RM11E 50cm DEM withing the mapping limits of the survey to be used for display purposes	Not to be used for engineering or design

Geospatial Data Set Name	Source	Description	Use Constraints
RM11E_Map_HS	DEA	Hillshade from RM11E DEM	Not to be used for engineering or design
RM11E_Model	DEA	RM11E 50cm DEM withing the modeled limits of the survey to be used for display purposes	Not to be used for engineering or design
RM11E_Model_HS	DEA	Hillshade from RM11E DEM	Not to be used for engineering or design
Detected_Trench_Limits	DOF	Limit of detected trench	None Identified
Marine_Tone_Locates	DOF	Location of marine tone	None Identified
PacifiCorps_Projected_Tone_Locate	DOF	Projected tone location	None Identified
PacifiCorps_Tone_Locates	DOF	Tone locate points	None Identified
Vault	DOF	Vault locations	None Identified
9-1 Active Docks	DOF	Active Docks in RM11E Area	None Identified
9-2 Constrained Access	DOF	Areas with constrained access	None Identified
9-2 Navigation Access	DOF	Navigational access areas	None Identified
9-2 Submarine Cable Crossing Caution Zone	DOF	approximate cable crossing zone	None Identified
9-3 Existing Structures	DOF	Structures in RM11E Area	None Identified
9-3 Groups of Vertical Piles	DOF	Groupings of pilings	None Identified
9-3 Large Debris line	DOF	Outlines of large debris	None Identified
9-3 Large Debris poly	DOF	Polygons of large debris	None Identified
9-3 Large Undifferentiated Debris	DOF	unknown	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
9-4 Oversteepened Slopes	DOF	Delineated areas of steep sloped terrain	None Identified
9-5 Adjacent Shoreline Propeller Wash	DOF	Propeller wash along shoreline	None Identified
9-5 Deep Draft Propeller Wash	DOF	Deep draft propeller wash	None Identified
9-5 Majority Wave Force 6to13	DOF	Majority wave force	None Identified
9-5 Shallow Draft Propeller Wash	DOF	Shallow draft propeller wash	None Identified
9-5 Wave Zone 0 to 23-3	DOF	Wave zone	None Identified
RM11E Hydrodyn Impact Polys	DOF	Prop wash and wave zones	None Identified
ISR Wave Zone Mod to High Impact	DOF	Hatch Zone 4, 0-13	None Identified
SheetpileWall	DOF	Sheet Pile walls in RM11E Area	None Identified
Dig-DOF-Features-From-Aerial-Structures_line	DOF	Corrupt file	None Identified
Dig-DOF-Features-From-Aerial-Structures_polygon	DOF	Structures digitized from aerial	None Identified
Dig-DOF-Features-From-Aerial_line	DOF	Corrupt file	None Identified
Dig-DOF-Features-From-ShtPile wall_line	DOF	Sheet pile walls digitized from aerial	None Identified
Remnant_Pilings_polygon	DOF	Remnant piling areas digitized from aerial	None Identified
SV-BS-X-DOFI0009	DOF	CAD Files	None Identified
RM11E DEA 2018 Contours	DOF	CAD Files	None Identified
XSEC LOCS 5-1	DOF	CAD Files	None Identified
RM11E_DEA_2018_CONS	DOF/DEA	Bathymetric Contours 1' intervals	None Identified
XSEC_LOC_5-1	DOF	DOF Cross Sections lines w/ labels	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
XSEC_LOC_5-1 r	DOF	DOF Cross Sections lines	None Identified
DEABathy	DOF/DEA	Bathymetric Contours 1' intervals	None Identified
Highlighted_Contours	DOF/DEA	Bathymetric Contours in the RM11E area, -30, 10, and 25	None Identified
PM_Sect_Grid	DOF	Cross Section lines every .02 RMs on the site	None Identified
PM_STA_TICS	DOF	Tick marks every .02 RMs, correspond with cross Section lines	None Identified
PM_STA_TXT	DOF	Labels for cross section lines	None Identified
Proj Align	DOF	Cross section lines are perpendicular to alignment line	None Identified
Proj Align 100ths marker	DOF	Project mile 100ths markers	None Identified
Proj Align 10ths marker	DOF	Project mile 10ths markers	None Identified
Structure from 3D Partial	DOF	Four structures	None Identified
USACE RiverMile-Channel	DOF	River channel	None Identified
USACE RiverMile-Channel TXT	DOF	River mile markers with text	None Identified
RM11E_3dModel_Sept2013	DOF	Unknown	None Identified
Aerial	DOF	Aerial Photo of Site Area	None Identified
RM11E_DEA_Merged_Surface	DOF/DEA	Merged bathymetry and upland elevations	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
RM11E_DEA_Merged_Surface_Contours	DOF/DEA	5' Interval contours of merged bathymetry and upland elevations	None Identified
RM11E_DEA_Merged_Surface_HS	DOF/DEA	Hillshade of merged bathymetry and upland elevations	None Identified
SDU_20130922	EPA	EPA delineated sediment decision units (SDU)	None Identified
capping_20110128	Integral	Portland harbor capped areas	None Identified
Dredge_20110128	Integral	Portland harbor capped areas	None Identified
EPA_Alts_wCongeners_minusCap	LWG	SMA alternatives B through G.	None Identified
EPA_Alts_wTotDF_minusCap	LWG	SMA alternatives B through G.	None Identified
WR_2014_Channel	USACE	Delineated Willamette Channel	None Identified
ddx_sma	GSI	SMA Delineation for DDX in RM11E	None Identified
pah_dsm	GSI	SMA Delineation for PAH in RM11E	None Identified
PCB_SMA	GSI	SMA Delineation for PCB in RM11E	None Identified
pecdd_sma	GSI	SMA Delineation for PECDD in RM11E	None Identified
sma_all	GSI	Combined SMA Delineation of DDX, PAH, PCB, PECDD and TCDD	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
tcdd_sma	GSI	SMA Delineation for TCDD in RM11E	None Identified
Albina_GeoRegion	GSI	Unknown	None Identified
ALTF_Benthic_Risk_Combined	GSI	Unknown	None Identified
AOPC25	Anchor QEA	Area of Potential Concern	None Identified
Borings	GSI	Borings and Geotechnical Borings	None Identified
Bridges	GSI	General outline of Freemont Bridge	None Identified
Building_Outlines	GSI	Building Footprints	None Identified
BulkHead_Wall	GSI	General location of Bulkhead wall	None Identified
Cable_Crossing	GSI	PacificCorp cable crossing	None Identified
Cable_Crossing_Caution_Zone	GSI	Zone around PacificCorp cable crossing	None Identified
Capped_Dredged_Areas	GSI	Capped/Dredged Areas in the RM11E Area	None Identified
COE_Navigation_Channel	ACOE	Navigation Channel - delineated by Army Corp of Engineers	None Identified
43_Lines	GSI	OF Basin 43 conveyance Lines	None Identified
43_Points	GSI	OF Basin 43 conveyance Points	None Identified
44_Lines	GSI	OF Basin 44 conveyance Lines	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
44_Points	GSI	OF Basin 44 conveyance Points	None Identified
45_Lines	GSI	OF Basin 45 conveyance Lines	None Identified
45_Points	GSI	OF Basin 45 conveyance Points	None Identified
Dolphins	GSI	RM11E Area Dolphins	None Identified
DT_Reach_Study_Area_RM11_8to16_6	COP	Boundary of the "Downtown Reach" - RMs 11.8 to 16.6	None Identified
Existing_MW	GSI	Existing Wells and Borings	None Identified
Fiber_Optic_Crossing	GSI	Approximate location of fiber optic line in Willamette	None Identified
Fiber_Optic_Easement	GSI	Approximate location of fiber optic line in Willamette Easement	None Identified
Former_Unnamed_Gulch	DOGAMI	approximate boundary of unnamed gulch	Not intended for site specific investigations
Generalized_Select_Taxlots	GSI	simplified Tax Lots of interest in RM11E area	None Identified
Historical_Maintenance_Dredge_Areas	GSI	Areas of previous dredging	None Identified
MHW_OHW_and_OLW_Elev_Lines	GSI	Mean high, ordinary high and ordinary low water lines	None Identified
PH_Rivermile_Tenths	COP	0.1 River Miles from 0 to 27	None Identified
PH_Rivermile_Tenths_from_USACE	USACE	0.1 River mile markers from 10.0 to 11.7	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
PH_Rivermiles	COP	whole river miles from 0 to 27	None Identified
PH_Study_Area_RM1_9to11_8	GSI	Boundary of the "Portland Harbor" - RMs 1.9 to 11.8 including the Multnomah Channel	None Identified
PH_Superfund_Site	GSI	Official boundary of the Portland Harbor Superfund Site, RMs 1.9 to 11.8	None Identified
Project_Area_Outfalls	GSI	City Outfalls within the RM11E Area	None Identified
Properties_Interest	METRO	10 properties of interest within the RM11E Area	For product terms and conditions, please see http://www.oregonmetro.gov/index.cfm/go/by.web/id=505
River_Structures	GSI	Structures within the River in the RM11E Area, i.e., Piers or pilings	None Identified
Riverbank_Boundary	GSI	Riverbank edge in the RM11E Area	None Identified
RiverBndy_RM0to40	COP	River boundary from RM0 to RM40	Do not distribute without permission
RM11E_Geology	DOGAMI	Geology in the RM11E Area	Not intended for site specific investigations
RM11E_HS	Unknown	Hillshade in the RM11E Area	None Identified
RM11E_lidar	Unknown	LiDAR in the RM11E Area	None Identified

Geospatial Data Set Name	Source	Description	Use Constraints
RM11E_Project_Area	GSI	Delineation of RM11E Project Area	None Identified
RM11E_Project_Area_Lines	GSI	Delineation of RM11E Project Area	None Identified
RM11E_RAL_Area	GSI	Unknown	None Identified
Taxlots	METRO	Tax lots in the vicinity of RM11E	None Identified
Top_of_Bank	GSI	Top of bank line in RM11E	None Identified
Upland_and_Bathymetric_Contours	GSI	1 ft contour lines, upland and inriver	None Identified
VesselApproachrt	GSI	Unknown	None Identified