UPDATED FINAL

Fish Tissue Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

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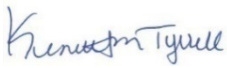
CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



August 20, 2018

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Technical Services
ASAOC	Administrative Settlement Agreement and Order on Consent
BEHP	bis-2-ethylhexylphthalate
BHHRA	baseline human health risk assessment
COC	contaminant of concern
CSM	Conceptual Site Model
D/U Reach	the Downtown Reach and the Upriver Reach
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
GPS	global positioning system
Gravity	Gravity Marine Services
GSI	GSI Water Solutions, Inc.
ID	identification
LWG	Lower Willamette Group
mm	millimeter
NAD	North American Datum of 1983
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PDI	pre-remedial design investigation
PHSS	Portland Harbor Superfund Site
Pre-RD AOC Group	Pre-Remedial Design Agreement and Order on Consent Investigation Group
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RM	river mile

ROD	Record of Decision
RV	research vessel
Site	Portland Harbor Superfund Site
SMA	sediment management area
SMB	smallmouth bass
SOP	Standard Operating Procedure
SOW	Statement of Work

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (U.S. Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec) and AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigation and Baseline Sampling (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes the Statement of Work (SOW) and the PDI Work Plan (an attachment to the SOW), which generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, and fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the fish tissue sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018). To the extent practicable, previously approved FSPs from the RI are referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Site extends from river mile (RM) 1.9 upstream to RM 11.8 and covers 2,190 acres (Figure 1). There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4. Collectively, the river from RM 11.8 to 28.4 is referred to as the D/U Reach.

1.2 Project Overview

The target species of the PDI 2018 Fish Tissue Study is smallmouth bass (SMB; *Micropterus dolomieu*) because of their abundance, more limited home range, extensive historical chemistry database, and importance in the baseline human health risk assessment (BHHRA). This study

builds on prior SMB sampling in the PHSS, including the 2002 and 2007 RI, the 2011 program (GSI Water Solutions, Inc. [GSI] 2011), and the 2012 program (Windward Environmental 2012)[1]. The focus of this sampling effort is the collection of whole body SMB throughout the Site and upstream of the Site to characterize current concentrations of ROD Table 17 contaminants of concern (COCs).

1.3 Fish Tissue Sampling Goals and Objectives

The PDI sampling provides a synoptic baseline chemistry dataset for sediment, fish tissue, and surface water for use in future long-term monitoring of the PHSS. As outlined in the QAPP, the goals of the PDI for fish tissue sampling include the following:

- Characterize current levels of fish tissue COCs in resident SMB tissue on a site-wide basis and smaller spatial scale.
- Characterize upriver concentrations in fish tissue.
- Update statistically based evaluations of polychlorinated biphenyl (PCB) differences and changes in fish tissue concentrations.
- Update and evaluate study area conditions to refine the CSM for all pathways consistent with the ROD.

2. SAMPLING DESIGN AND APPROACH

This section describes the sample design, sampling schedule, sample locations, sample size, and other sampling considerations. The overall design and methods are consistent with the *Sampling and Analysis Plan: Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study* (GSI 2011) and *Portland Harbor RI/FS: 2012 Modifications to the Field Sampling Plan for Bass Tissue* (Windward Environmental 2012).

2.1 Fish Sampling Design

SMB have been collected from the Site several times, including 2002, 2007, 2011, and 2012, and analyzed for COCs in fillet and whole body tissue using individual and composite samples. The overall PDI sample design for SMB is consistent with the most recent and approved 2012 SMB program, which included sampling and analysis of whole body specimens throughout the Site and a portion of the D/U Reach. The design includes collection of one specimen from each of 95 sampling locations within the Site, as well as 20 specimens from the Downtown Reach and 20 from the Upriver Reach. The target number of specimens within the Site is the same as the 2012

[1] SMB tissue chemistry data collected as part of the 2011 and 2012 sampling programs were not included in the RI dataset.

program. While a total of 135 SMB are targeted, the number collected will be to the extent sufficient numbers of fish are present in the summer/fall of 2018.

2.2 Fish Sampling Schedule

Fish collection is expected to include two 10- to 12-day sessions: one session in August before Labor Day and one in September after Labor Day. This schedule includes a safety rest break over the Labor Day holiday weekend. The field schedule may be affected by adverse weather and fishing success. At the end of the first 10- to 12-day sampling session, the SMB catch rate will be evaluated in consultation with EPA to determine if adjustments to the FSP are needed to achieve the target sample number.

An optional boat electrofishing session (described below in Section 4.3.2) is proposed if numbers of specimens caught by hook-and-line angling at the proposed sampling locations are not sufficient.

2.3 Sampling Locations

A total of 135 sampling locations are proposed for the 2018 Study (Figures 2a and 2b). Within the PHSS, the 95 sampling locations include areas that were successful in the 2011 and 2012 SMB studies and provide coverage of both sides (east and west) of the river and the SMAs. The sample design targets 20 to 30 samples in each of the four segments of the PHSS: RM 1.9 to 5 (Segment 4); RM 5 to 7.5 (Segment 3); RM 7.5 to 9 (Segment 2); and RM 9 to 11.8 (Segment 1) with samples collected from the east and west sides of the river. Within the D/U Reach, 40 sampling locations are proposed to characterize upriver concentrations in resident fish tissue. Half of the sampling locations (n=20) are in the Downtown Reach and include locations previously sampled in the 2011 and 2012 programs. The remaining 20 sampling locations are located throughout the Upriver Reach up to Willamette Falls. Table 1 presents the proposed 2018 sample locations (final positioning will change based on the specific locations where fish are caught).

2.4 Specimen Lengths

Consistent with the 2011 and 2012 sampling, SMB that are 225 to 355 millimeters (mm) in total length (approximately 9 to 14 inches) will be targeted. Specimens that do not meet the target size range will be released. SMB larger than 355 mm may be retained for archival at the selected laboratory for possible future analysis. If there are insufficient numbers of SMB collected in the target size range, larger SMB of up to 460 millimeters will be accepted if necessary based on consultation with EPA. Specimens will be measured in millimeters as shown in Appendix B, Field Forms: Specimen Tally and Location Form.

2.5 Other Sampling Considerations

The specimens will be frozen and shipped to the laboratory for processing as whole fish samples. No compositing or filleting of SMB specimens will occur in the field. If any tagged fish from the Fish Tracking Study are caught, the tagged fish will not be retained. The capture location and tag identification number will be documented and the tagged fish returned to the water as carefully and quickly as possible.

2.6 Key Changes from Previously Approved FSPs

Fish sampling will be performed in accordance with EPA-approved project plans (GSI 2011, Windward Environmental 2012), except where noted. Key PDI changes include the following:

- Samples will be analyzed for the COCs listed in ROD Table 17 for fish tissue (presented in Table 6 of the PDI Work Plan).
- In addition to sample preparation and analysis by Axys, an additional laboratory (ALS) will be used for analysis of specific ROD Table 17 COCs, as specified in Section 5 of this FSP and the project QAPP.
- Tissue sample identification codes will be modified to describe the 2018 PDI sampling, as described in Section 4.2.1 of the QAPP.

3. PROJECT ORGANIZATION AND FIELD TEAM

3.1 Team Organization and Responsibilities

EPA is the lead agency overseeing the work. The EPA Project Manager is Davis Zhen. EPA will be assisted in the review of technical documents by an oversight contractor.

Team organization is presented in detail in the PDI Work Plan and in Section 2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM is coordinating activities, including management of all subcontractors, field sampling, analysis, and reporting scoping tasks.

The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, Ph.D. (AECOM), will be responsible for overall project coordination and providing oversight on planning and coordination, work plans, all project deliverables, and performance of the administrative tasks needed to ensure timely and successful completion of the project. Ms. Betsy Ruffle (AECOM) will serve as the senior technical lead for this study. Dr. Pretare is also the Project Field Coordinator (FC). In this role, she will oversee all phases of work, including planning, permitting, health and safety, logistics, field sample collection, sample packaging, and shipment to the laboratory. Dr. Pretare will be responsible for overall field study implementation

and field data quality. Deviations from this FSP will not be made without prior approval from the FC. Dr. Pretare will oversee the preparation of the field report.

Mr. Andy Clodfelter and Mr. Glen Mejia (AECOM) are the Fish Tissue Study fisheries biologists. Ms. Josie Smith (AECOM) will be a qualified Fish Supervisor. Mr. Clodfelter, Mr. Mejia, or Ms. Smith may act as field supervisor at times when Dr. Pretare is not present at the study area. All are qualified to implement fish tissue collection, maintain field documentation, and address any stipulations that may arise from scientific collection permits or Endangered Species Act (ESA) compliance for the study. The team will include fisheries biologists who are trained and qualified to identify and document any incidental catch of ESA-listed species.

The research vessels (RV) for this study will be provided by Gravity Marine Services (Gravity). Mr. Shawn Hinz is the point of contact for Gravity. One primary RV will be at least 30 feet in length and have capacity for up to 8 people, including observers, fishing gear, and coolers for sample storage. A second RV will be a smaller "jon boat" of less than 15 feet in length for navigating into nearshore areas. Gravity will provide RV captains and crew who are qualified to fish for SMB and to assist in tissue collection procedures. All team members will have valid State of Oregon fishing licenses.

The Oregon Bass & Panfish Club will assist as fishing guides and anglers. Volunteers from this organization have assisted the LWG and EPA in previous studies and have experience supporting scientific studies within Portland Harbor.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP. The FC will be the point of contact for field staff during the implementation of this FSP. Deviations from this FSP or the project-specific QAPP will be reported to the PDI Project Manager for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA.

3.2.1 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager a minimum of 1 week prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

4. SAMPLE COLLECTION PROCEDURES

This section describes the procedures and methods that will be used for sample collection; recordkeeping; sample handling, storage, and shipping protocols; and field quality assurance (QA)/quality control (QC) procedures. Sample collection will follow procedures outlined in the

2012 Modifications to the Field Sampling Plan for Bass Tissue (Windward Environmental 2012) and the *Sampling and Analysis Plan: Portland Harbor 2011 Baseline Smallmouth Bass Tissue Study* (GSI 2011). The intended sample locations are described in Section 2.3 and displayed in Figures 2a and 2b and Figures 3a through 3i. Sampling will be conducted using a two-boat team. The smaller boat will have a boat operator and an angler. The remaining team members and any observers will be located on the larger RV. The precise team configuration may vary on a given day, but at a minimum one scientist and one angler not otherwise engaged in vessel operations will be present. The boat operator and deck hand will also serve as an angler when not operating the vessels. All field work will be conducted in accordance with the project-specific Health and Safety Plan (AECOM and Geoysntec 2018b). Standard Operating Procedures (SOPs) associated with the fish tissue collection program are provided in Appendix A.

4.1 Sampling Vessel and Equipment

Sampling vessels will be provided and operated by Gravity. The proposed sampling vessels are R/V *Tieton* or other vessels at least 22 feet in length with space for gear, staff, and an observer. The R/V *Tieton* is a 32-foot landing craft type vessel with a 16-foot working deck that provides a stable platform for fish sampling and angling.

4.2 Station Positioning and Navigation

Station position and navigation will be performed using methods outlined in the SOP for Horizontal and Vertical Survey Control (Appendix A) . For the Fish Tissue Study, the hand held Trimble R1 GPS units described on page 5 of the SOP will be used to collect latitude and longitude coordinates. The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD83), State Plane Coordinate System, Oregon North Zone. Survey control points PH-1 and/or PH-2 will be used as a daily accuracy check, depending on where field crews are operating on a given day.

The positioning objective is to accurately determine and record the position of the sampling vessel at each planned sampling location to within 1 to 2 meters. Once positioned at a planned sampling location, SMB angling specialists and fisheries biologists will determine fishing spots based on specific habitat preferences for SMB and angler expertise. The intent is to focus on fishing in spots with a high probability to capture SMB while still maintaining distribution of sampling locations spread throughout the PHSS and D/U Reach. The fish sample collection location will be recorded. Water depth of the fish sample location will be recorded using the research vessel's depth transducer, when available. In shallow water, a visual estimate or lead line measurement of depth may be used.

4.3 Fish Collection

4.3.1 Angling

The fish collection SOP is provided in Appendix A. Angling will be conducted using a standard rod and reel with monofilament line (6-12 pound test). SMB can be caught with a variety of lures, depending on the desired sampling depth. For example, lead-weighted hooks with attached green-rubber tube jigs can be used to fish the bottom, while plastic crank baits resembling small fish or crayfish can be used to fish the shallower surface waters (zero to 4 meters). An electric trolling motor will be used on the Gravity-operated jon boat to more accurately access specific angling locations and enable the complete coverage of selected areas. Angling for SMB will be conducted primarily from 7:00 a.m. to 7:00 p.m. Once caught, fish will be handled using nitrile gloves, unhooked, and its length measured in millimeters on a decontaminated measuring board. If a collected SMB is within the target size, it will be euthanized, weighed, and placed into individual labeled resealable plastic bags and placed in a cooler with ice as described in Section 4.3.4. AECOM scientists will be on board each boat to handle and document the fish and to record the GPS coordinates of the capture location of each fish electronically and in the sampling records.

If ESA-listed species are caught during angling, all fishing efforts will stop in that sampling area and the field crew will move to a different sampling area, as directed by the fisheries biologist onboard. The species and specimen health will be recorded on the tally form as described in Section 4.3.4, Field Sample Handling, and the fish will be returned to the water as quickly as possible. The National Marine Fisheries Service (NMFS), EPA, and Oregon Department of Fish and Wildlife (ODFW) will be notified by email at the end of the sampling day. The procedures for reporting incidental catch of ESA-listed species will be confirmed during pre-sampling coordination with NMFS.

4.3.2 Boat Electrofishing

If an insufficient number of SMB are caught by angling, boat electrofishing is proposed as an alternate collection method. Selection of boat electrofishing gear will be based on biological and environmental factors that influence gear efficiency. If boat electrofishing is required, an addendum to this FSP will be developed. The decision to implement electrofishing will be made in concert with EPA, and electrofishing would likely occur in mid to late September after initial angling efforts have been completed.

4.3.3 Contingency Plan for Collecting Samples

During fish sampling efforts, the field crew may encounter field conditions that preclude collection of a SMB specimen at the planned sampling location. For example, the combination of unsuitable river levels, currents, bathymetry, physical obstructions, and absence of catchable fish may preclude collecting a sample at the target sampling location. If no target-sized SMB are captured within 30 minutes at a single planned sampling location, the field crew will move to

another planned sampling location. Effort will be taken to revisit target fish collection locations that were previously unproductive during the early morning or evening when SMB are more active feeders. Unproductive target locations will be visited at least twice if a sample is not collected from that location during the initial visit. If fishing effort is unproductive at a planned sampling location during the second visit, the field crew will select an alternate sampling location in an under-represented area to maintain targeted spatial distribution of collected samples and ensure sampling is sufficiently spread throughout the four segments of the PHSS and D/U Reach and each side of the river is properly represented. Samples will be assigned the sample identification (ID) of the closest planned sample station. Handheld GPS units will be pre-programmed with sampling target locations as shown in Table 1 of the FSP. Anglers will use their current location as displayed on the handheld GPS to determine the closest planned sample location. The planned number of samples relative to sample stations, segment, and east or west sides of the river will be tallied in the logbook daily. Each day, the spatial data will be downloaded and post-processed as described in the Data Quality Management Plan. The tally of sampling locations will be updated if needed and communicated to the field team daily.

4.3.4 Field Sample Handling

All field equipment used to collect and process fish will be decontaminated. All buckets, measuring boards, handheld scales, and coolers used to retrieve and store fish will be washed with Alconox™ soap and rinsed in river water before sampling is initiated at each location.

The number and species of all fish caught during the sampling will be recorded on the Fishing Effort and Tally Form provided in Appendix B, Field Forms. The Fishing Effort and Tally Form will be used to record fish that were caught but not collected for various reasons (incorrect species or size) and to document fishing start-stop times.

Fish will be measured for total length by placing them on a measuring platform. The total length of a fish will be measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally). If the fish does not meet the target length range, the specimen will be returned to the river. Fish will be photographed as specified in the field documentation SOP.

Retained fish will be euthanized and weighed using a handheld scale suited for the weight of the fish. Weights of the fish will be measured in grams. Fish will be euthanized using a lethal dose of the anesthetic MS-222 (or other method recommended by the NMFS and/or ODFW, or as stated in the Scientific Take Permit). Once weighed, the fish sample will be wrapped in piece of clean aluminum foil and placed inside a resealable plastic bag as described in SOP-04 (Appendix A). All SMB processing will be performed on the larger primary research vessel. If SMB are caught on the smaller jon boat, they will be transferred to the larger researcher vessel for processing.

A weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag. All labels will be marked with the date, time, project name (or case

number), sample ID, and initials of the sampler, and the fish sample will be placed in a cooler with ice, as outlined in Section 4.3.4 of the QAPP and attached SOPs (Appendix A). Each retained fish and sample location will be photographed. GPS coordinates will be recorded in the field logbook.

At the end of each day, the coolers will be transported to the secure AECOM Sampling Processing Facility (1115 S.E. Caruthers Street), which will serve as a temporary processing and storage facility. The RVs may transfer fish coolers to field team members at the Swan Island Boat Ramp throughout the day depending on the success of the fish collection efforts. The fish will be transferred to a chest freezer for frozen storage at the AECOM facility. Once frozen, the fish will be placed into coolers with dry ice before shipment to the contract laboratory.

4.4 Management of Investigation-Derived Waste

Fish collected but not retained for analysis will be immediately returned to the lower Willamette River from where they were collected. Water containing diluted amounts of phosphate-free detergent (i.e., Alconox) used for decontaminating the sample processing equipment will also be released to the lower Willamette River at the same sample location. Other consumables such as disposable sampling equipment, fish surgical tools, and gloves will be bagged for disposal and managed as a solid waste and discarded as general municipal waste.

5. LABORATORY ANALYSIS

The chemical analysis of tissue samples will be performed by the following laboratories, or as specified in the QAPP (AECOM and Geosyntec 2018a):

- SGS Axys Analytical Services in British Columbia, Canada, will homogenize each whole body specimen as a discrete sample and analyze the samples for: chlorinated pesticides and hexachlorobenzene, PCB congeners, dioxins/furans congeners, polybrominated diphenyl ethers (PBDEs), and lipids.

- ALS Environmental in Kelso, Washington, will analyze homogenized tissue samples for arsenic, mercury, bis-2-ethylhexylphthalate (BEHP), and pentachlorophenol.

Laboratory QC and data validation protocols will be followed to ensure that data quality and representation are in accordance with method requirements. Additional information is provided in the QAPP. Laboratory QA/QC will be maintained through the use of standard EPA methods and other accepted methods and standard analytical procedures for the target analytes.

6. DATA MANAGEMENT AND REPORTING

All data management will be performed according to the QAPP and Data Quality Monitoring Plan.

6.1 Field Documentation and Reporting

A bound field logbook will be assigned to and maintained by AECOM field team members to provide daily records of significant events, observations, and measurements during the field effort. Each page will be numbered, signed, and dated. Logbooks will be retained as permanent records and will be kept on each sampling vessel. Complete field record-keeping details can be found in the project QAPP.

A brief activity log will be filed with the FC at the completion of each working day. This log will summarize the work activities undertaken/completed each day, progress, personnel on-site, hours worked, health and safety concerns, and any technical issues encountered. Field logbooks and field data sheets completed during fish collection activities will be scanned and emailed to the FC at the conclusion of each working day (or as soon as practically possible).

6.2 Plan Deviations

Deviations to this FSP potentially include the sampling of alternate stations or scope reductions/enhancements related to site conditions or real-time information. Safety will be given the highest priority in all aspects, and the Project FC/PDI Project Manager will be responsible for documenting all plan deviations.

6.3 Data Management and Retention

All related documentation is to be maintained in the project file either in electronic or hardcopy form. All hardcopy records will be maintained in the project file; all electronic records will be maintained in project-specific directories within AECOM's network and a final electronic data deliverable (EDD) will be provided to EPA at the conclusion of the PDI study.

7. REFERENCES

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TABLES

Table 1. Sample Identification Number and Coordinates

Sample Identification Number	X Coordinate	Y Coordinate
1	7617437.7142	724272.0737
2	7617263.7133	723910.0749
3	7617134.7124	723598.0760
4	7617024.7111	723191.0772
5	7616907.7092	722636.0788
6	7616830.7075	722149.0802
7	7616816.7057	721700.0814
8	7615061.7092	721237.0857
9	7616822.7032	721094.0829
10	7615093.7067	720644.0872
11	7615153.7044	720121.0885
12	7615191.7022	719604.0898
13	7615224.6998	719042.0913
14	7618403.6826	717182.0898
15	7618976.6808	717174.0887
16	7617968.6828	716893.0914
17	7618159.6799	716318.0925
18	7616685.6813	715566.0974
19	7616879.6789	715130.0981
20	7618423.6767	715734.0934
21	7617145.6766	714745.0986
22	7617334.6745	714359.0991
23	7617495.6725	713994.0997
24	7619391.2799	714508.5321
25	7619824.7946	713282.6833
26	7618265.6635	712344.1021
27	7618709.6592	711594.1030
28	7619090.6557	711000.1035
29	7619452.6523	710436.1041
30	7619834.6489	709867.1045
31	7621605.6410	709180.1019
32	7621091.6390	708320.1051
33	7622526.6347	708289.1016
34	7621964.6324	707290.1053
35	7623394.6288	707436.1014
36	7622760.6270	706526.1050
37	7623615.6220	705897.1042
38	7624258.6239	706845.1005
39	7624442.6179	705458.1030
40	7625192.6185	706169.0995
41	7625134.6142	705025.1021
42	7626030.6094	704480.1008
43	7626773.6108	705582.0947
44	7627152.6096	705654.0925
45	7626699.6032	703567.0991

Sample Identification Number	X Coordinate	Y Coordinate
46	7627580.6026	704319.0928
47	7627609.5963	702777.0957
48	7628673.5951	703557.0885
49	7629560.5900	703150.0845
50	7628446.5899	702011.0928
51	7629919.5861	702534.0839
52	7628532.5858	701058.0942
53	7630455.5822	702097.0819
54	7628808.5824	700472.0939
55	7631196.5775	701677.0788
56	7631959.5738	701523.0750
57	7630201.5742	699831.0878
58	7632539.5722	701705.0715
59	7630870.5685	699074.0858
60	7633192.5680	701318.0688
61	7632882.5670	700741.0717
62	7631605.5609	697908.0843
63	7634185.5620	700811.0646
64	7632424.5548	697204.0814
65	7632957.5517	696951.0791
66	7633409.5492	696796.0771
67	7634401.5508	698198.0689
68	7635462.5526	699730.0600
69	7633863.5467	696619.0750
70	7634827.5476	697830.0674
71	7634364.5433	696280.0731
72	7635448.5434	697402.0650
73	7636408.5451	698803.0570
74	7636177.5386	696933.0622
75	7636817.5347	696589.0595
76	7637472.5302	696135.0571
77	7637191.5232	694077.0630
78	7637653.5226	694390.0599
79	7638614.5233	695559.0523
80	7638374.5181	693994.0569
81	7639902.5138	694478.0479
82	7639060.5129	693389.0547
83	7640408.5076	693415.0476
84	7639756.5075	692725.0525
85	7641240.5001	692370.0455
86	7640899.4948	690703.0510
87	7641982.4878	690029.0469
88	7643359.4818	689911.0400
89	7643030.4791	688912.0439
90	7644012.4769	689339.0379
91	7644650.4721	688795.0359

Sample Identification Number	X Coordinate	Y Coordinate
92	7644119.4706	687877.0407
93	7645078.4677	688101.0352
94	7645566.4626	687313.0345
95	7645132.4623	686811.0379
96	7645445.3815	686564.7458
97	7645822.0459	686849.6407
98	7646853.5698	685599.2552
99	7646331.3209	684049.3944
100	7646579.3624	682830.8042
101	7646291.7428	681175.8296
102	7645250.4226	679628.3747
103	7646565.1471	676323.0265
104	7647960.6522	675471.2880
105	7646167.0084	673739.5106
106	7648189.1830	673056.6121
107	7646255.1585	672363.1848
108	7649903.0087	670977.8868
109	7645328.9706	671121.7443
110	7646369.4045	669386.5068
111	7647151.3829	668746.0813
112	7648972.6263	668328.1753
113	7647120.3784	667557.0862
114	7646048.2965	666503.0160
115	7645738.3739	665044.1027
116	7646059.3635	662694.1106
117	7647690.2094	661083.1267
118	7648242.2985	659449.6374
119	7648368.3358	657765.1203
120	7649424.3242	655746.1240
121	7651899.5541	655207.5844
122	7650961.5815	653033.4509
123	7650258.8245	650650.3818
124	7649306.6071	649544.8133
125	7648122.9732	645258.2968
126	7648711.1566	642577.7052
127	7650472.2796	641304.3745
128	7651101.5355	640038.5982
129	7654016.7734	637440.0272

Sample Identification Number	X Coordinate	Y Coordinate
130	7655627.8143	635179.3946
131	7657722.9447	631679.4096
132	7658373.9784	629403.4713
133	7660736.7413	628686.4587
134	7661588.8947	625612.0704
135	7658407.3683	622302.4298

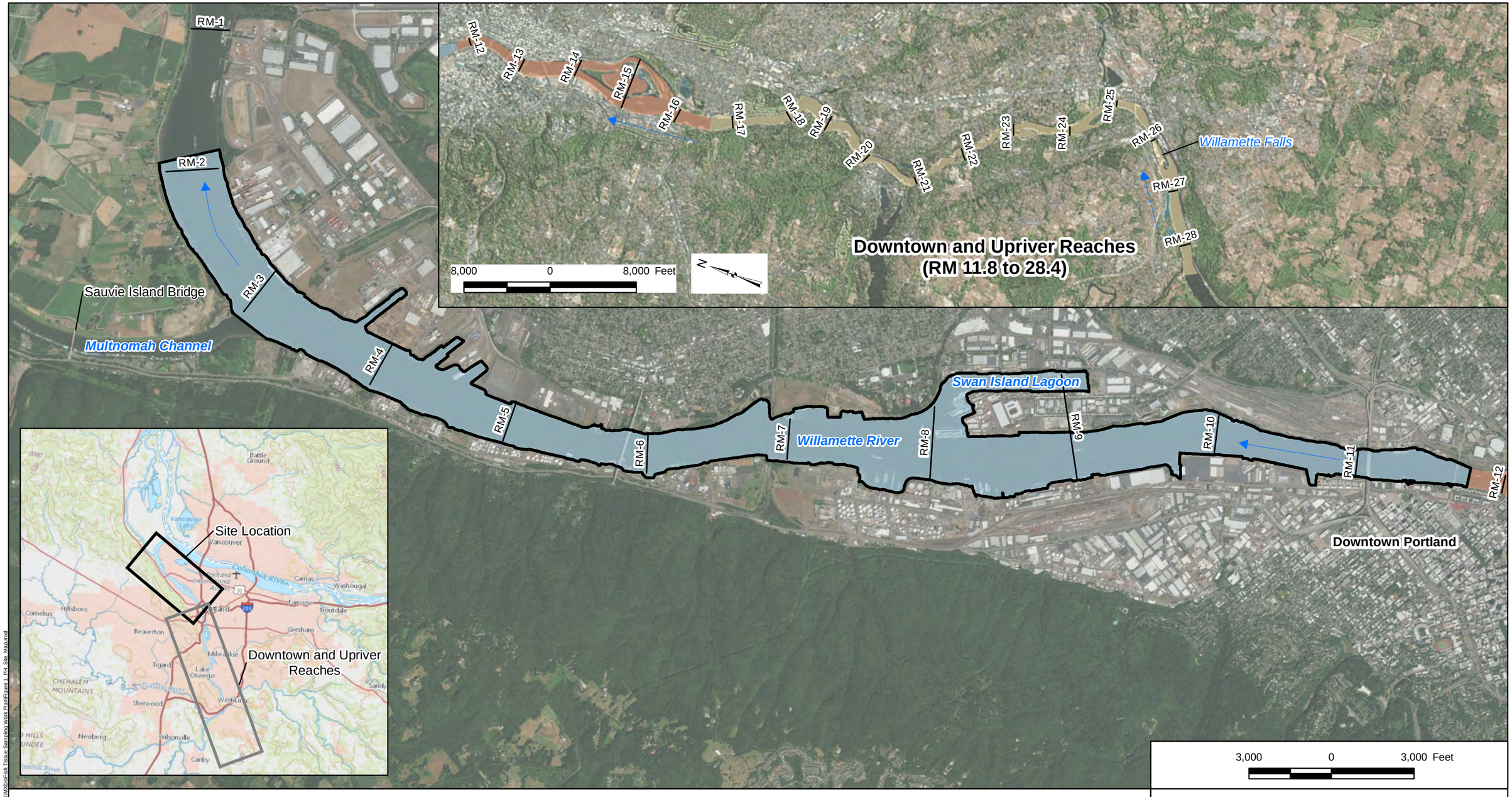
Notes:

1. Samples numbered sequentially based on location downstream to upstream from RM 1 to 135 (matches methodology used for other sampling locations).

2. Horizontal Projection: NAD 1983 Oregon State Plane North (Intl Feet)

Acronyms:
RM = river mile
NAD = North American Datum

FIGURES



Legend

- Flow Direction
- River Mile Marker
- Superfund Site Boundary (RM 1.9 to 11.8)

Study Area

- Site Area (RM 1.9 to 11.8)
- Downtown Reach (RM 11.8 to 16.6)
- Upriver Reach (RM 16.6 to 28.4)

Note:
1. Aerial Imagery provided by ESRI Basemaps 2016

Portland Harbor Site Map

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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MI/SEA	March 23, 2018	Figure 1

Path: P:\Projects\Portland Pre-Design\PN\G07\67A\900\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 1_PH_Site_Map.mxd

RM-0
RM-1
RM-2
RM-3
RM-4
RM-5
RM-6
RM-7
RM-8
RM-9
RM-10
RM-11
RM-12
RM-13
RM-14
RM-15
RM-16
RM-17
RM-18
RM-19
RM-20

Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- Alternative F Mod SMA Footprint

Note:
1. Aerial Imagery provided by ESRI Basemaps 2017
2. n - sample count, RM - River Mile, SMA - Sediment Management Area
3. Site defined as RM 1.9 to 11.8
4. The Downtown Reach is defined by EPA as extending from RM 11.8 to RM 16.6 and Upriver Reach is defined by EPA as extending from RM 16.6 to RM 28.4
5. Fish tissue sample collection locations shown in this figure are proposed and do not reflect final positioning based on field conditions

2,000 0 2,000 Feet

Summary of Proposed Fish Tissue Sampling Locations (RM 1.9 to 20)

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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MI/SEA | March 23, 2018

Figure 2a

Path: P:\Projects\Portland Pre-Design PN\60707A\900\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 2a_PH_FishTissueAll.mxd

Path: P:\Projects\Portland Pre-Design PN\0076\TA\8\900 GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 2b_PH_FishTissueAll.mxd

Legend

- ★ Proposed Fish Tissue Sample Location (n = 135)
- Alternative F Mod SMA Footprint

Note:
1. Aerial Imagery provided by ESRI Basemaps 2017
2. n - sample count, RM - River Mile, SMA - Sediment Management Area
3. Site defined as RM 1.9 to 11.8
4. The Downtown Reach is defined by EPA as extending from RM 11.8 to RM 16.6 and Upriver Reach is defined by EPA as extending from RM 16.6 to RM 28.4
5. Fish tissue sample collection locations shown in this figure are proposed and do not reflect final positioning based on field conditions

2,000 0 2,000 Feet

Summary of Proposed Fish Tissue Sampling Locations (RM 20 to 28.4)

Portland Harbor Superfund Site
PDI Fish Tissue FSP

AECOM Geosyntec consultants

Figure 2b

MI/SEA | March 23, 2018

RM-2
RM-3
RM-4
RM-5
1
2
3
4
5
6
7
8
9
10
11
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13
14
15
16
17
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21
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24
25
26
27
28
29
30
31

Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 1.9 to 5

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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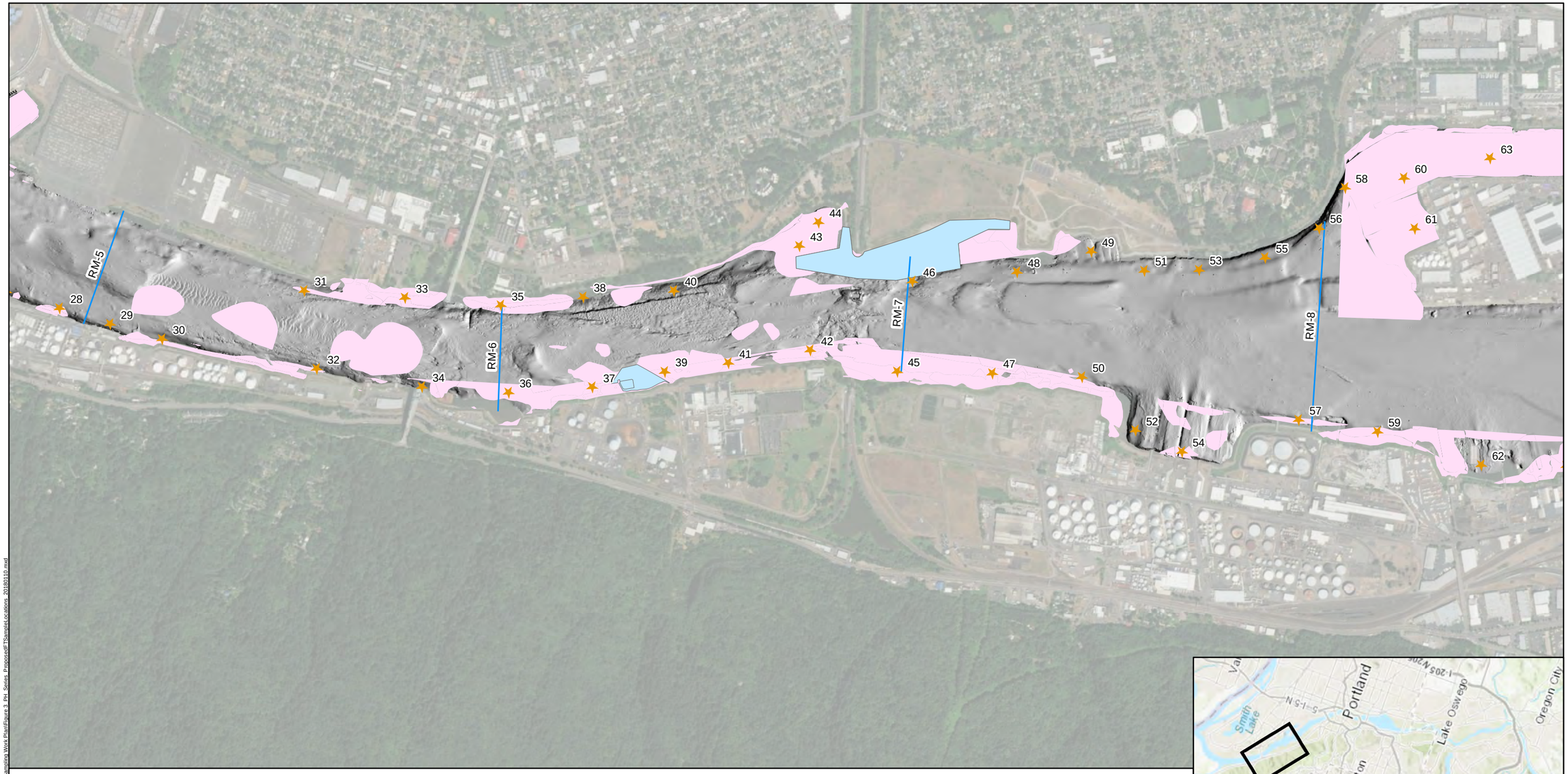
Figure **3a**

MI/SEA | March 23 2018

Path: P:\Projects\Portland Pre-Design PN\60767A\900\GIS and CAD\MXD\sFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 5 to 8

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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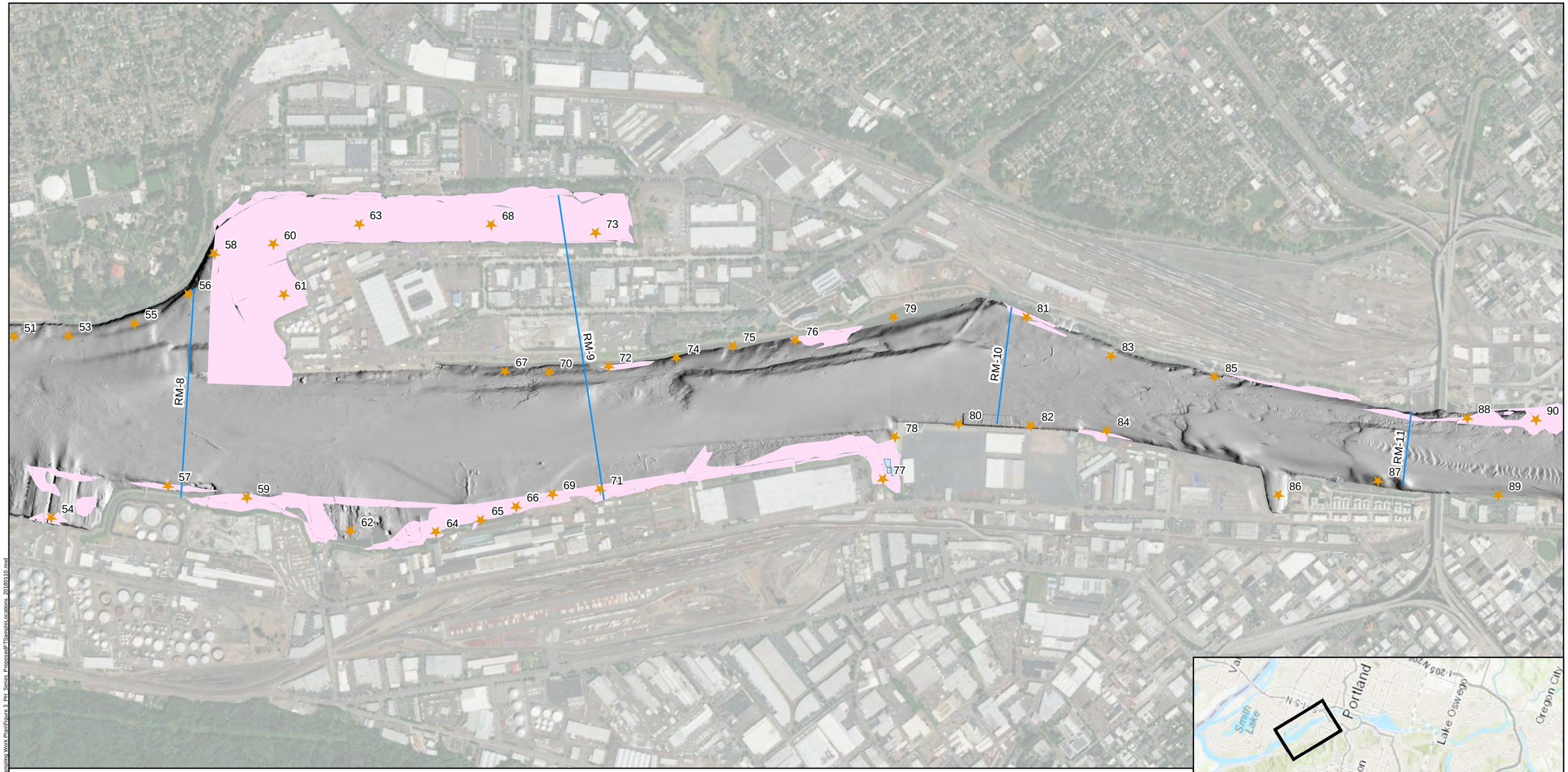
Figure **3b**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN\60767A\900 GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 8 to 11

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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Figure **3c**

MI/SEA | March 23 2018

Path: P:\Projects\Portland Pre-Design\PN\G07\67A\900\GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 3 PH Series ProposedFTSampleLocations 20180110.mxd

Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

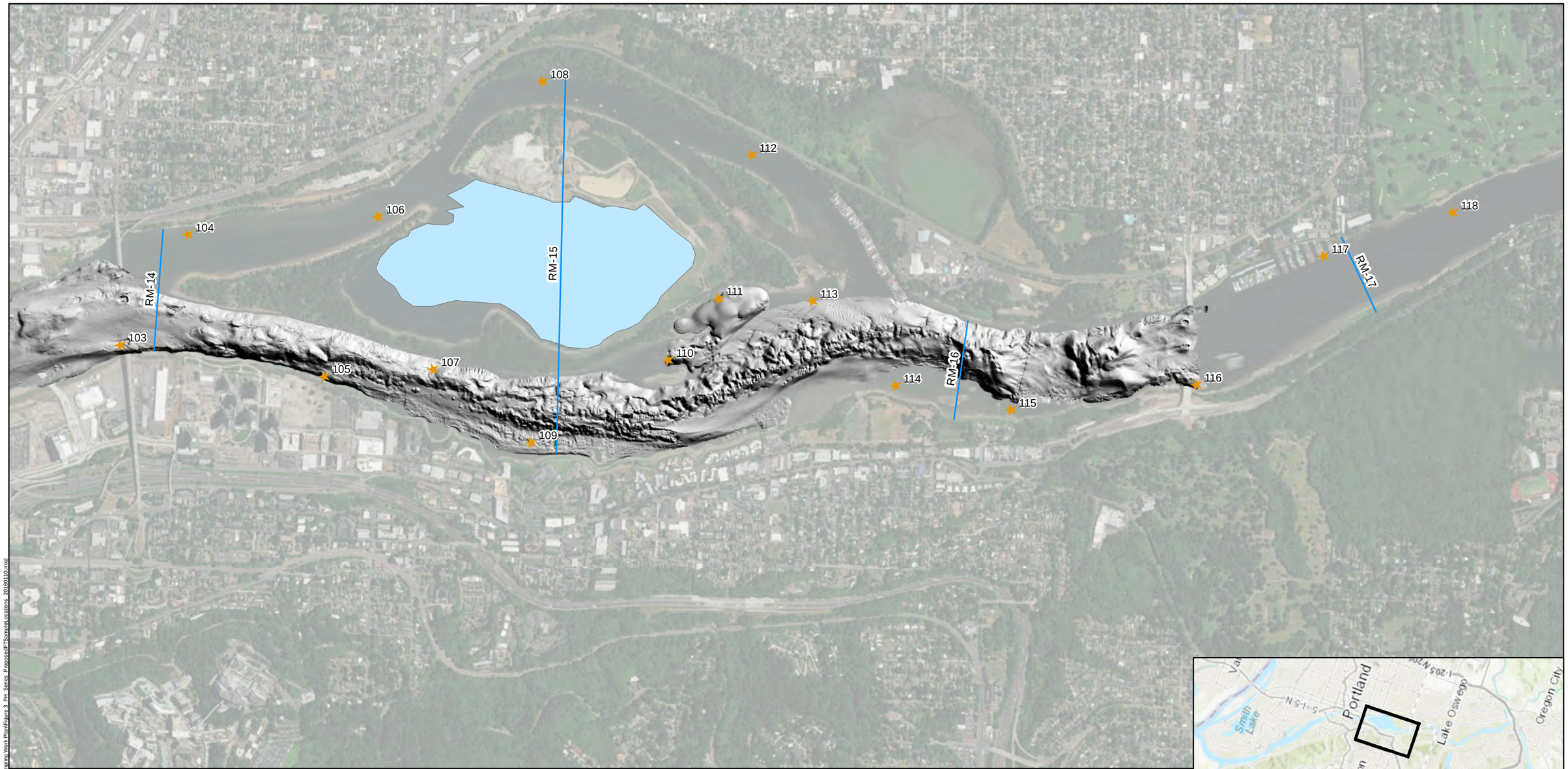
Proposed Fish Tissue Sampling Locations RM 11 to 14

Portland Harbor Superfund Site
PDI Fish Tissue FSP

AECOM Geosyntec consultants

MI/SEA	March 23, 2018	Figure 3d

Path: P:\Projects\Portland Pre-Design\PN\G0767A\900\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3 Prl. Series ProposedFTSampleLocations 20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

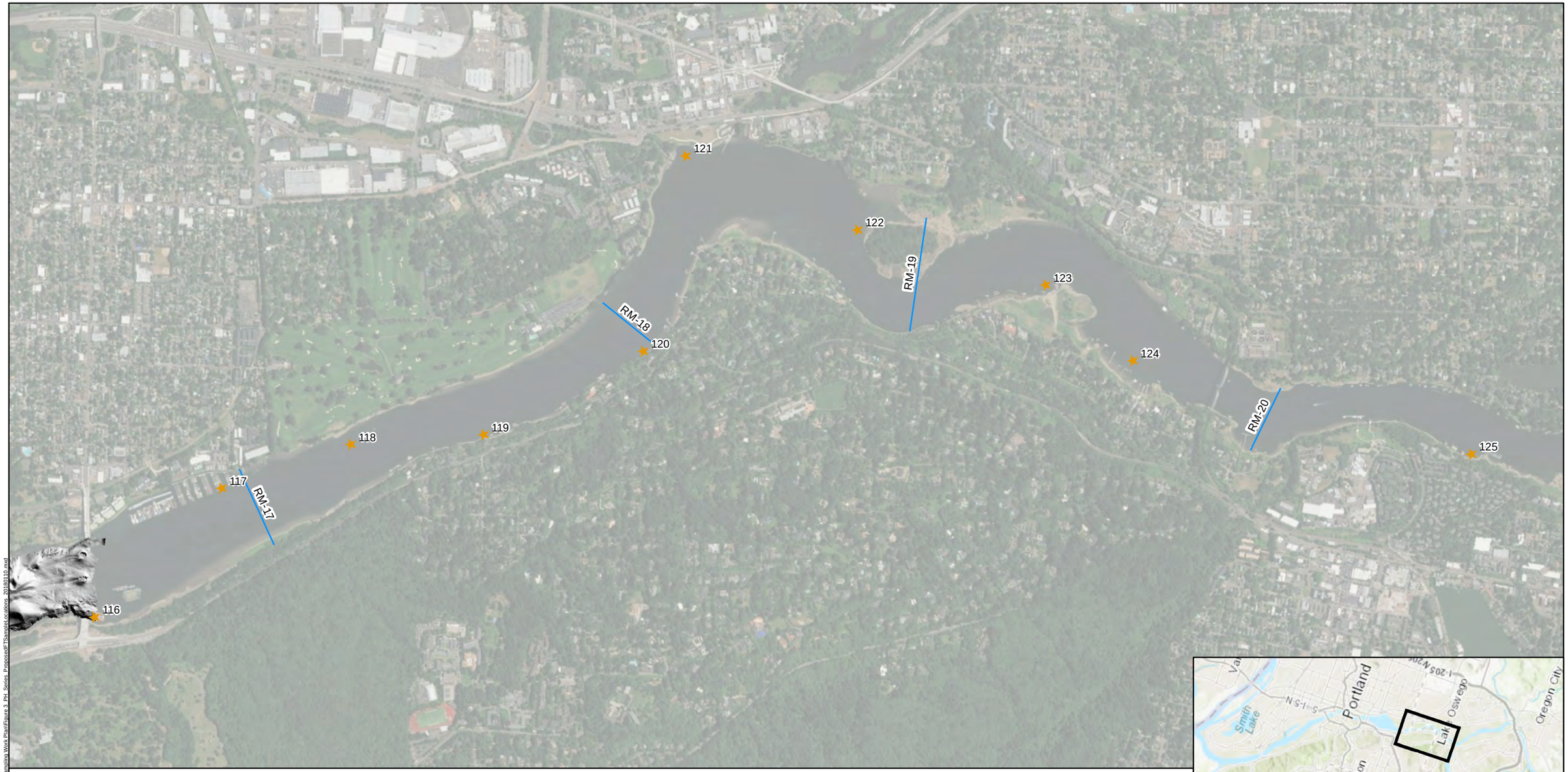
Proposed Fish Tissue Sampling Locations RM 14 to 17

Portland Harbor Superfund Site
PDI Fish Tissue FSP

AECOM Geosyntec consultants

MI/SEA	March 23, 2018	Figure 3e

Path: P:\Projects\Portland Pre-Design PN\G07\67A\900 GIS and CAD\MXD\Fish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd



Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 17 to 20

Portland Harbor Superfund Site
PDI Fish Tissue FSP

AECOM Geosyntec consultants

Figure **3f**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design\PN\G07\67A\900\GIS and CAD\MXD\dFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd

RM-20
125
126
RM-21
127
128
RM-22
129
RM-23
130

Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 20 to 23

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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MI/SEA	March 23, 2018	Figure 3g

Path: P:\Projects\Portland Pre-Design\PNG076\TA\900 GIS and CAD\MXD\sFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd

Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

1,000 500 0 1,000 2,000 Feet

Proposed Fish Tissue Sampling Locations RM 23 to 26

Portland Harbor Superfund Site
PDI Fish Tissue FSP

AECOM Geosyntec consultants

Figure **3h**

MI/SEA | March 23, 2018

Path: P:\Projects\Portland Pre-Design PN\60767A\900\GIS and CAD\MXD\sFish Tissue Sampling Work Plan\Figure 3_PH_Series_ProposedFTSampleLocations_20180110.mxd

134
135
RM-26
RM-27
RM-28

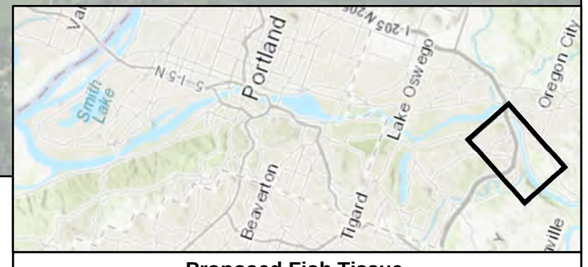
Legend

- Proposed Fish Tissue Sample Location (n = 135)
- Superfund Site Boundary (RM 1.9 to 11.8)
- River Mile Marker
- Capped Area (Existing)
- Alternative F Mod SMA Footprint

Notes:
1. Aerial Imagery provided by ESRI Basemaps 2017.
2 Hillshade derived from 2009 NOAA bathymetric survey.
3. n - sample count, RM - river mile, SMA - Sediment Management Area.

N

1,000 500 0 1,000 2,000 Feet



Proposed Fish Tissue Sampling Locations RM 26 to 28.4

Portland Harbor Superfund Site
PDI Fish Tissue FSP

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MI/SEA	March 23, 2018

Figure **3i**

Path: P:\Projects\Portland Pre-Design PN\G07\87A\900\GIS and CAD\MXDs\Fish Tissue Sampling Work Plan\Figure 3 PH_Series_ProposedFTSampleLocations_20180110.mxd

APPENDIX A

Standard Operating Procedures

- Decontamination
- Digital Camera Use
- Field Documentation
- Fish Tissue Sampling
- Recording Sample Location
- Sample Labeling
- Sample Packaging and Shipping
- Horizontal and Vertical Survey Control (rev. August 2018)

STANDARD OPERATING PROCEDURE SOP-01

DECONTAMINATION

Scope and Applicability

This standard operating procedure (SOP) describes procedures for decontaminating sampling and processing equipment contaminated by inorganic and organic materials. To prevent potential cross-contamination of samples, all reusable sampling and processing equipment will be decontaminated before each use. Decontaminated equipment will be stored away from areas that may cause recontamination. When handling decontamination chemicals, field personnel will follow all relevant procedures and will wear protective clothing as stipulated in the project health and safety plan (HASP).

Equipment and Materials

Equipment and materials for this task include the following:

- Plastic bucket(s) (e.g., 5-gallon bucket)
- Properly labeled squirt bottles (or large spray bottles if needed)
- Long-handled, hard-bristle brushes
- Plastic sheeting, garbage bags, and aluminum foil
- Tap water or river water
- Personal protective equipment, as specified in the HASP

Decontamination Procedures

When necessary, reusable sampling equipment should be decontaminated before and after the sampling effort, between sampling stations, and at any other times specified by the field sampling plan (FSP). The specific procedures for decontaminating reusable sampling equipment are as follows:

1. Rinse the equipment thoroughly with tap or river water to remove any visible sediment or debris.
2. Pour a small amount of concentrated laboratory detergent (e.g., Alconox) into a bucket (e.g., about 1/2 tablespoon per 5-gallon bucket) and fill it halfway with tap or river water. If the detergent is in crystal form, all crystals should be completely dissolved prior to use.
3. Scrub the equipment in the detergent solution using a long-handled brush with rigid bristles, using a back-and-forth motion. Be sure to clean the outside of samplers,

bowls, and other tools that may be covered with sediment or tissue. Remove all particulate matter and surface films.

4. Rinse with tap or river water. Equipment does not need to be dried before use.
5. If the decontaminated sampling equipment is not to be used immediately, wrap small items in aluminum foil (dull side facing the cleaned area).
6. If the sample collection or processing equipment is cleaned at the field laboratory and transported to the sampling site, then the decontaminated equipment will be wrapped in aluminum foil (dull side facing the cleaned area) and stored and transported in a clean plastic bag (e.g., a trash bag) until ready for use, unless the FSP lists special handling procedures.

STANDARD OPERATING PROCEDURE SOP-02

DIGITAL CAMERA USE AND DOCUMENTATION PROCEDURES

Purpose

The purpose of this standard operating procedure (SOP) is to describe the use of digital cameras and procedures for digital camera data management.

Scope and Applicability

This SOP is applicable to taking digital photographs and placing the digital data in a database. Digital photographs may be taken to document field activities, site conditions and features, and sampling locations.

Equipment and Materials

Equipment and materials for taking digital photographs include the following:

- Digital camera
- Spare batteries
- Digital camera-carrying case and manual
- Photo log form
- Dry-erase board
- Dry-erase marker
- Personal computer
- Black waterproof pen

Typical Camera Features

- Save photographs (in standard mode) directly to a memory stick or comparable device
- Auto focus; manual focus available if required
- Zoom
- Brightness control
- Playback of photographs on camera screen
- Display of photograph number, date, and time
- Flash
- Timer

- Display showing time remaining on battery and remaining disk capacity
- Ability to protect and delete images that have been taken

Camera Use

Digital cameras will be used by the field team to document field activities. Each field team will be directly responsible for the camera to ensure that it is not exposed to excessive heat, cold, or moisture. The field team leader will be responsible for digital photograph documentation or for assigning documentation duties to a team member.

Digital photographs will be taken to document field activities and locations. Examples of field activities for which photo documentation will be useful include 1) individual samples; 2) sampling location; and 3) field sampling techniques used, such as equipment use and operation.

Each individual sample and each sample location will be photographed. A minimum of three photographs of each field sampling technique will also be photographed.

Digital photographs will be collected at a high-pixel setting such that enlargements can be made with minimal degradation in picture quality.

Photograph Documentation

Field Team Responsibilities

Each field team will keep a daily hard copy log of all photographs. The following digital photograph data will be collected:

- Date and time—as provided by the camera display.
- Team members—list each team member.
- Camera identifier (type, model, equipment number).
- Sample Location ID, if applicable. This information is obtained from the field team leader and/or Data Quality Management Plan (DQMP). This ID should be written onto a dry erase board and included in the photo frame.
- Sample ID, if applicable. This ID should be written onto a dry erase board and included in the photo frame.
- Photograph ID—record the number of the photograph and the photograph file name (as coded below).
- Description—the target of the photograph.

Digital Photograph File Name

At the end of each field day, the member of the field team who is responsible for the camera will transfer the electronic data from the camera to the field operations computer. The folder structure will be as follows (or as specified in the DQMP):

\\DATA\PHOTOS\YYYYMMDD\SAMPLE AREA\file\[1, 2, 3, ...N]

The notation YYYYMMDD represents the year, month, and day. The sample area is the sampling area name (e.g., Willamette River). The individual files for the day (e.g., file 1, file 2, file N) will be placed within this folder using the default file identifier provided by the camera.

Transfer of Information and Archive

After the photograph disks have been uploaded, the original hard copy of the photograph log will be initialed and dated by the team member who downloaded the photographs, then archived by the field team leader.

Sample Processing Coordinator Responsibilities

The field team leader will be responsible for 1) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; 2) collecting and archiving the hard copies of the photograph logs; 3) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; and 4) notifying the sampling team leader of apparent inconsistencies and making recommendations for corrective action.

Key Checks and Items

Important checks for digital camera management include the following:

- Make sure the camera's battery is fully charged on a daily basis.
- Keep extra memory sticks available.
- To save battery life, use flash only when necessary.
- Make sure the camera quality level is set at "best" or equivalent (high pixel).
- Review photograph records periodically to ensure that the electronic photographs, dry erase board information, and the Specimen Tally and Location Form agree.
- Leave enough time at the end of the field day to transfer the data.

STANDARD OPERATING PROCEDURE SOP-03

FIELD DOCUMENTATION

Scope and Applicability

This standard operating procedure (SOP) presents the general information that will be documented for all sampling activities conducted by field personnel. Proper record keeping will be implemented in the field to allow samples to be traced from collection to final disposition. All information pertaining to field operations during sample collection must be properly documented to ensure transparency and reproducibility of methods and procedures. Several types of field documents will be used for this purpose by field personnel.

Equipment and Materials

Equipment and materials used for this SOP include the following:

- Field logbook, preferably Rite-in-the-Rain 8.5 x 11 inch spiral-side notebook
- Field forms
- Black-ink waterproof pen
- Digital camera

Field Logbooks

During field sampling events, field logbooks and field forms are used to record all daily field activities. The purpose of the field logbook is to thoroughly document the sampling event to ensure transparency and reproducibility. The field logbook will contain sampling-related information supplemental to the field forms. Any deviations from the project-specific field sampling plan (FSP) that occur during sampling (e.g., personnel, responsibilities, sample station locations) and the reasons for these changes will be documented in the field logbook. Other types of information, as applicable, that should be documented in the field logbook include the following:

- Project sampling name and type
- Name of person making entries and other field staff
- On-site visitors, if any
- Observations made during sample collection, including collection complications and other details not entered onto the field form
- A record of health and safety meetings, updates, and related monitoring
- Presence of vessel traffic, construction and maintenance activities, or man-made features that may influence sampling

- Specific measured characteristics of collected samples

The field supervisor will maintain the field logbook and is responsible for ensuring that the field logbook and all field data forms are correct. Requirements for logbook entries will include the following:

- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be documented, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The field supervisor must sign and date the last page of each daily entry in the field logbook.
- Logbooks will be photographed daily and copied or scanned weekly, and backups of data will be generated as specified in the Data Quality Management Plan.
- When field activity is complete, the logbook will be scanned into the project file, and originals will be retained by the Project Manager.

All logbook entries must be completed at the time any observations are made. Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field logbooks to be copied. A discussion of copy distribution is provided below.

Field Forms

Field data forms will be used to record the relevant sample information collected during a sampling event. These forms will be filled out completely by the sampling team during sampling.

The Fishing Effort and Tally Form will be used to record data on all fish caught and shall include the following:

- Sampling date (YYYY-MM-DD)
- Sampling location
- Angler initials
- Fishing start and stop times (24-hour Pacific Standard Time)
- Total duration of fishing effort; this will used to calculate catch per unit effort

- Catch time (24-hour Pacific Standard Time)
- Catch species, Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LMB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, STH= steelhead
- Health examination will include general condition, injuries, survivability after release.
    - Good: Rapid swimming away on release, usually with a vigorous splash.
    - Fair: Slow but strong swimming away on release.
    - Poor: Short recovery time (up to 30 seconds) required; once recovered, slow but sometimes atypical swimming away on release.
    - Very poor: Long recovery time (more than 30 seconds); once recovery, limited or no swimming observed on release but respiration functional.
    - Dead: Dead on removal from gear or does not recover following removal from gear.

For any SMB that are caught, the Smallmouth Bass Specimen Tally and Location Form will be used and data to be recorded shall include:

- Collection date and time (YYYY-MM-DD and 24-hour Pacific Standard Time)
- Sample ID
- Sample Location ID
- Fork and total length in millimeters
- Weight in grams
- Health examination, including gill condition, fin condition, visible parasites, and presence/absence of lesions
- Retained for analysis or tagging?
- Sample location depth to mudline in feet
- Sample location coordinates

Upon completion of the field sampling event, the field supervisor will be responsible for submitting all field data forms to be copied. A discussion of copy distribution is provided below.

Photographs

Reference SOP-02 of the FSP for procedures regarding digital photographs.

Distribution of Copies

Electronic scans of the field logbooks and field data forms will be made after completion of the field sampling event and stored electronically in the project files for use by project staff. The original field logbooks and forms will be placed in a locked file cabinet at the Project Manager's location.

Set-up of Locking File Cabinet

Each field event will have its own dedicated section in a locking file cabinet. The section label will include the project name and work order number. The following documents may be included in this cabinet for each field event:

- Original field logbook(s)
- Original field data forms
- Original signed chain-of-custody forms

STANDARD OPERATING PROCEDURE SOP-04

FISH TISSUE SAMPLING

Scope and Applicability

This standard operating procedure (SOP) describes the procedures for fish tissue sampling. Collection, handling, and processing procedures for fish tissue sampling of a variety of fish species at the Portland Harbor Superfund Site were previously described in the U.S. Environmental Protection Agency-approved Portland Harbor Fish Tissue Sampling SOP (SEA et al. 2002), incorporated here by reference. This SOP focuses on smallmouth bass (*Micropterus dolomieu*) tissue collection using angling (hook and line).

Equipment and Materials

Equipment and materials for this task include the following:

- Personal protective equipment as specified in the project Health and Safety Plan (HASP)
- HASP and scientific collection permits (as needed)
- Field location maps
- Bait-casting or spinning rod, with medium action and rated for an 8- to 12-pound line and 1/4- to 3/4-ounce lure or similar.
- Monofilament line (6-12 pound line)
- Lures: plastic worms, crankbaits (diving plugs), spinnerbaits, jigs, top-water lures, swimbaits
- Dip net
- Decontamination supplies
- Resealable plastic bags, black permanent markers, waterproof labels, and aluminum foil
- Appropriately sized fish measuring board (in millimeters)
- Hanging fish scale (in grams)
- Plastic bucket(s) (e.g., 5-gallon bucket)
- Sample containers/coolers and ice
- Rite-in-the-rain field notebooks
- White board and dry erase markers

- Boat-mounted GPS or handheld differential GPS device
- Fish anesthetic (MS-222 or other method recommended by the National Marine Fisheries Service and/or Oregon Department of Fish and Wildlife, or as stated in the Scientific Take Permit)

Target Species, Species Length, and Number of Specimens

The target species for this SOP is smallmouth bass. The target size is 225 to 355 millimeters (9-14 inches) in total length. Specimens that do not meet the target range will be released. Smallmouth bass larger than 355 millimeter up to 460 millimeters (14 to 18 inches) may be retained for archival at the laboratory for possible future analysis. The targeted number of specimens for chemical analysis is 135 smallmouth bass as follows: 95 from the Site, plus 20 from the Downtown Reach and 20 from the Upriver Reach. Specimens will be measured in millimeters.

Fish Sampling Techniques

Fish collection will be exclusively by angling. However, if an insufficient number of smallmouth bass are caught by angling, boat electrofishing is proposed, and a separate boat electrofishing SOP will be developed. Bass fishing techniques tend to be based on the type of lure. As described in previous sampling plans, smallmouth bass can be caught with a variety of lures, depending on the desired sampling depth. Lead-weighted hooks with attached green-rubber tube jigs can be used to fish the bottom, while plastic crank baits resembling small fish or crayfish can be used to fish the shallower surface waters (zero to 20 feet). Electric trolling motors may be used to more accurately access specific smallmouth angling locations and enable the complete coverage of selected areas. Angling for smallmouth bass will be conducted primarily from 7:00 a.m. to 7:00 p.m.

Fish Processing and Identification

Qualified biologists will be a part of each team to oversee fish processing. All buckets, measuring boards, handheld scales, and coolers used to retrieve and store fish will be washed with Alconox^{TM} soap and rinsed in river water before the sampling effort is initiated at each sampling location.

Once caught, fish will be handled using nitrile gloves, unhooked, and identified. Non-target species will be released. Retained smallmouth bass specimens will be measured for total length by placing them on a measuring platform. The total length of a fish will be measured from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally). If the length requirement is not met, the specimen will be returned to the river. Smallmouth bass that have met the target size will be rinsed with river water to remove any foreign material from the external surface, and a general fish health examination will be conducted. A general fish health examination will include gill condition, fin condition, visible parasites, and presence/absence of lesions.

Retained fish will be weighed using a handheld scale, euthanized, wrapped in aluminum foil, and placed inside a resealable plastic bag. Fish will be euthanized using a lethal dose of the anesthetic MS-222 (or other method recommended by the National Marine Fisheries Service and/or Oregon Department of Fish and Wildlife, or as stated in the Scientific Take Permit). A weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag.

When wrapping the fish sample, foil should be folded with space away from the spiny dorsal fin to minimize punctures. The aluminum foil in addition to the plastic bags is intended to protect the sample from cross-contamination and storage on ice.

All labels will be marked with the date, time, project name (or case number), specimen identification (ID), and initials of the sampler, and the fish sample will be placed in a cooler with ice. Each retained fish will be photographed along with the habitat conditions at each sampling location. Photographs of fish and sampling location will contain the sample number written on a white board included in the frame. GPS coordinates, sample number, date, time and other pertinent information will be recorded in the field logbook.

At the end of each day, the coolers will be transported to the secure AECOM laboratory (1115 S.E. Caruthers Street), which will serve as a temporary processing and storage facility. The research vessels may transfer fish coolers to field team members at the Swan Island Boat Ramp throughout the day depending on the success of the fish collection efforts. The fish will be transferred to a chest freezer for frozen storage at the AECOM facility. Once frozen, the fish will be placed into coolers with dry ice before shipment to the contract laboratory.

References

SEA, Windward, and Kennedy/Jenks. 2002. Fish Tissue Sampling SOP Round 1A Portland Harbor RI/FS. Prepared for Lower Willamette Group, Portland, OR. Striplin Environmental Associates, Inc., Olympia, WA.

STANDARD OPERATING PROCEDURE SOP-05

RECORDING SAMPLE COLLECTION LOCATIONS

Scope and Applicability

This standard operating procedure (SOP) describes procedures recording sampling stations across the Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling (PDI) Site (hereafter the Site). Accurate station positioning is required to ensure quality and consistency in collecting samples and in data interpretation and analysis. Station positioning must be both absolutely accurate in that it correctly defines a position by latitude and longitude, and relatively accurate in that the position must be repeatable.

Latitude and longitude coordinates will be obtained using a global positioning system (GPS) on the vessels operated by Gravity and supplemented by a hand-held differential GPS unit.

The methods described in this SOP should be usable for any hand-held differential GPS unit; however, the owner's manual for any GPS unit used should be consulted and used to support this SOP.

Equipment and Materials

The following is a list of equipment and materials needed by the field sampling team:

- Hand-held differential GPS unit (e.g., Trimble GeoXH or R1)
- Spare batteries
- Charging unit

A GPS hardware system, such as a Trimble GeoXH, R1, or equivalent device, should be used for recording the location of each sample. The standard projection method to be used during field activities is specified in the Data Quality Management Plan.

Positioning System Verification

GPS requires no calibration because all signal propagation is controlled by the United States government (the Department of Defense for satellite signals and the U.S. Coast Guard and U.S. Forest Service for differential corrections). Verification of the accuracy of the GPS requires that coordinates be known for one (or more) horizontal control points within the study area. The GPS position reading at any given station can then be compared to the known control point. GPS accuracy verification shall be conducted at least daily and performed in accordance with equipment manufacturer recommendations.

Station Location Procedures

Sampling area boundaries and other applicable geographic information systems (GIS) data layers (e.g., aerial photographs, topography) will be uploaded into the hand-held GPS unit(s)

prior to the sampling effort. A position will be recorded electronically at each sample location where fish are collected. Ancillary information will be recorded in the field logbook and should include the name of the personnel operating the GPS system and the time samples were collected. Water depth of the sample collection location will be recorded using the research vessel's depth transducer, when available. In shallow water, a visual estimate or lead line measurement of depth may be used.

A brief summary of procedures to locate a specific sampling location using a hand-held GPS unit are as follows:

- Turn on the unit.
- Wait for it to acquire the location of satellites.
- Save the location into the GPS memory (site coordinates may also be noted on field forms or in the field logbook).
- Charge unit and batteries when not in use.

Upon completion of the sampling effort, all data points will be downloaded from the GPS unit and displayed on a GIS map. Any sampling locations outside of the originally defined sampling areas will be mapped and described with supporting documentation in the field sampling report.

STANDARD OPERATING PROCEDURE SOP-06

SAMPLE LABELING

Scope and Applicability

This standard operating procedure (SOP) describes the general procedures for completing sample labels that will be used for all sampling. The project-specific field sampling plan (FSP) should be consulted regarding the rationale behind the sample labeling protocol.

Equipment and Materials

Equipment and materials for this task include the following:

- Sample labels
- Indelible marker
- Copy of the FSP and DQMP

Sample Identifiers

Sample identifiers will be established before field sampling begins and assigned to each sample as it is collected. Sample identifiers consist of codes designed to fulfill three purposes: 1) to identify related samples to ensure proper data analysis and interpretation, 2) to clearly connect sample results to sampling locations, and 3) to track individual samples to ensure that the laboratory receives all of the material associated with a single sample. The Data Quality Management Plan (DQMP) contains details of the location and sample nomenclature to be used in this study.

Sample Labels

Sample ID information will be entered onto the sample label with an indelible marker. Other information that will be entered onto the sample label includes the following:

- Samplers' initials
- Date
- Time

The format for the date and time will be specified as YYYY-MM-DD and 24-hour, Pacific Time. If necessary, corrections will be made on the sample labels by drawing a single line through the error and entering the correct information with an indelible marker. All corrections will be initialed and dated by the person performing the correction (i.e., the individual who made the error).

For fish samples, a weatherproof label will be filled out and adhered to the inside of a smaller resealable plastic bag. The plastic bags containing the fish and the label then will be placed inside a third resealable plastic bag. Sample packaging is discussed in SOP-07.

STANDARD OPERATING PROCEDURE SOP-07

SAMPLE PACKAGING AND SHIPPING

Scope and Applicability

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein. This standard operating procedure (SOP) presents the method to be used when packaging samples that will either be hand-delivered or shipped by commercial carrier to the laboratory.

Equipment and Materials

Specific equipment or supplies necessary to properly pack and ship environmental samples include the following:

- Field sampling plan (FSP)
- Project-specific field logbook
- Resealable airtight bags (assorted sizes)
- Shipping coolers
- Drum liners or sturdy trash bags for securing samples within coolers
- Fiber-reinforced packing tape and duct tape
- Clear plastic packing tape
- Scissors or knife
- Chain‑of‑custody (COC) forms; these forms may be produced in an electronic format using a database program, in which case a computer and printer would be needed as well
- COC seals
- Large plastic garbage bags (preferably 3 mil [0.003 inch] thick) for cooler lining
- Paper towels
- “Fragile,” “This End Up,” or “Handle With Care” labels and “Perishable Goods” labels
- Address labels for processing laboratory
- Airbills for overnight shipment

Procedure – Fish Tissue

After completing each day of sampling, all fish tissue samples will be transferred from the coolers with wet ice into a freezer or cooler with dry ice and held there until preparation for shipment to the laboratory. Although there is no specified duration of time after collection that samples must be frozen, sample transfer will be done as soon as the field crew returns to the location where samples are being held. The temperature of the cooler/freezer will be recorded in the logbook twice daily (both in the morning and evening).

Depending on the logistics of the operation, field personnel may transport samples to the laboratory themselves or use a commercial courier or shipping service. If a courier service is used, then field personnel should be aware of potentially limiting factors to timely shipping (e.g., availability of overnight service and weekend deliveries to specific areas of the country and shipping regulations regarding "restricted articles") prior to shipping the samples.

Sample Storage Prior to Shipment

Samples will be placed in secure storage (i.e., locked warehouse) or remain in the possession of sampling personnel before shipment. Sample storage areas will be locked and secured to maintain sample integrity and COC requirements. The appropriate storage temperature will be maintained for samples in a secure area while they are awaiting shipping.

Sample Preparation for Fish Tissue Samples

Staff responsible for shipping samples on dry ice will be trained in Dangerous Goods regulations. Staff will also contact FedEx International Customer Service at 1-800-463-3339 prior to packaging samples to determine to most up-to-date regulations for shipping samples to British Columbia, Canada. A "FedEx Shipping Dry Ice" job aid is added to this SOP for reference. The following steps should be followed to ensure the proper transfer of samples from the field to the laboratory.

At the Sample Collection Site and Following the Completion of the Sampling Day

1. Document all samples appropriately using the proper logbooks or field forms and required sample container identification (i.e., sample labels with unique identification numbers [IDs]) by following the sample labeling procedures described in SOP-06.
2. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross contamination.
3. Place labeled and bagged fish tissue samples in a second resealable plastic bag such that the sample label can be read, and place double-bagged sample into a cooler.
4. Because the samples have a required storage temperature, place a sufficient amount of wet ice in the sample cooler to maintain the temperature inside the cooler (e.g., 4°C) throughout the sampling day.

5. At the end of each sampling day, transfer fish tissue samples from the coolers with wet ice into a freezer or cooler with dry ice, and hold there until preparation for shipment to the laboratory.

To Prepare Fish Tissue Samples and Coolers for Shipping

1. Choose the appropriate shipping cooler(s) for dry ice; make sure that the outside and inside of the cooler is clean of gross contamination.
2. Line the cooler with bubble wrap.
3. Concurrently with placing samples in the shipping cooler(s), the field supervisor will fill out COC forms with sample IDs and laboratory analyses to be performed.
4. Make sure any applicable laboratory quality control sample designations have been made on the COC forms.
5. Check sample IDs for all samples against the COC form to ensure all samples intended for shipment are included.
6. Place samples inside a large plastic bag (e.g., sturdy garbage bag or drum liner); the bag will be tied closed and sealed at the tied area with a custody seal to ensure that custody is maintained if the cooler is opened for inspection during shipment.
7. Because the samples have a required storage temperature, add enough dry ice to keep the samples frozen during overnight shipping (i.e., <0°C). The amount of dry ice that may be required should always be overestimated. Ice should be enclosed in a resealable plastic bag and then placed in a second resealable plastic bag to prevent leakage. Avoid separating the samples from the ice with excess bubble wrap because it will insulate the containers from the ice.
8. Sufficient fish tissue samples will be placed in each cooler to occupy approximately 60 to 70 percent of the cooler volume, and the remaining space in the cooler will be filled with dry ice.
9. After all samples and ice have been added to the cooler, use bubble wrap (or other available clean packing material) to fill any empty space to keep the samples from shifting during transport.
10. The field supervisor will sign and date the completed COC form and retain a copy for the project files. Place the signed COC form in a resealable bag and tape the bag containing the form to the inside of the cooler lid. Each cooler should contain an individual (or multiple) COC form(s) for the samples contained in that particular cooler.
11. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with fiber-reinforced packing tape. The cooler should be taped

shut using nylon strapping tape around the opening between the lid and the bottom of the cooler and around the circumference of the cooler at both hinges.

12. As security against unauthorized handling of the samples, apply two COC seals across the opening of the cooler lid—one on the front of the cooler and one on the side. Be sure the seals are properly affixed to the cooler so they are not removed during shipment. Additional clear packing tape across the seal may be necessary if the outside of the cooler is wet.
13. Appropriate shipping labels indicating the use of dry ice should be affixed to the containers.
14. Attach the address label for the processing laboratory, overnight shipping bill, a perishable goods label, and at least one of the following labels: "This End Up," "Fragile," or "Handle With Care."
15. Notify the laboratory project manager and quality assurance manager that samples will be shipped and the estimated arrival time. Upon completion of field activities, the field supervisor will provide copies of all COC forms to the task manager and task analytical chemistry quality assurance and quality control (QA/QC) coordinator.

Sample Shipping

Hand Delivery to the Testing Laboratory

1. The field supervisor will notify the laboratory contact and the team project QA/QC coordinator that samples will be delivered to the laboratory and the estimated arrival time.
2. All samples that are hand-delivered to the testing laboratory will be received by the laboratory on the same day that they were packed in the coolers.
3. Copies of all COC forms will be provided to the task manager.

Shipped by Commercial Carrier to the Laboratory

1. Use an address label and label the cooler with destination and return addresses, and add other appropriate stickers, such as "This End Up," "Fragile," and/or "Handle With Care" as well as "Perishable Goods" labels. If the shipment contains multiple coolers, indicate on the address label the number of coolers that the testing laboratory should expect to receive (e.g., 1 of 2; 2 of 2). Place clear tape over the mailing label to firmly affix it to the outside of the cooler and to protect it from the weather. This is a secondary label in case the airbill is lost during shipment.
2. Fill out the airbill as required and fasten it to handle tags provided by the shipper (or the top of the cooler if handle tags are not available).

3. Frozen fish tissue samples may be shipped on Monday through Thursday, with overnight service.

SHIPPING DRY ICE

Introduction

Many perishable items, such as food, medical shipments or non-hazardous chemicals, are shipped with dry ice as a refrigerant. As long as the dry ice is not chilling a dangerous good (as defined by the U.S. Department of Transportation or the International Air Transport Association), the procedures for shipping are straightforward and easy. When a *company* ships dry ice the shipment must be prepared by an employee **trained** in the Dangerous Goods regulations. For information or to register for FedEx Express Dangerous Goods Seminars, go to **fedex.registration.meetingevolution.net.**

Before You Prepare Your Shipment

When shipping internationally, call FedEx International Customer Service at 1.800.GoFedEx 1.800.463.3339 and say "international services" to check commodity acceptability by service and origin in combination with the destination city/postal code/country. Some service limitations also exist for Alaska and Hawaii. Call 1.800.GoFedEx 1.800.463.3339 for more information.

How To Prepare a Dry Ice Shipment

1. Package

- Dry ice releases carbon dioxide gas which can build up enough pressure to rupture the packaging. You must ensure the packaging you use allows the release of this pressure to prevent rupturing the package. For example, do not use steel drums or jerricans as outer packaging, and do not place dry ice within sealed plastic bags.
- Use good quality fiberboard (corrogated cardboard), plastic or wooden boxes. FedEx® packaging may not be used.
- A layer of Styrofoam within a box works well as insulation. Ensure the styrofoam IS NOT sealed to be airtight.
- Styrofoam must not be used as an outer packaging unless it has been preapproved by FedEx Packaging Services (1.800.633.7019).
- The maximum amount of dry ice per package is 200 kg.
  Exception: Overpacks containing dry ice and shipments which meet Special Provision A151.

2. Mark

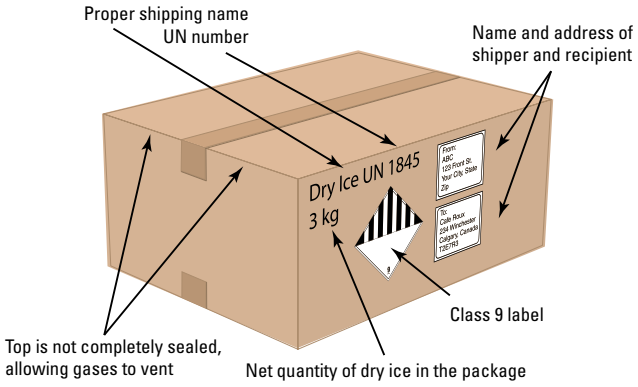
- The following package markings are required:

a. Dry Ice (or Carbon Dioxide Solid)
   Note: The Proper Shipping Name, namely Dry Ice (or Carbon Dioxide Solid) must be on the same surface of the package as the hazard label or Class 9 label, when package dimensions are adequate.

b. UN 1845

c. The net quantity of dry ice in the package or overpack, in kilograms (1 kg = 2 lb).

- The name and address of both the shipper and recipient must be durably marked. This information can be marked on the package



All self-adhesive labels must be affixed directly to the package. Do not place labels in, or on, a plastic pouch.

itself, or you can mark the shipper and recipient information in the address blocks of the FedEx Express Dry Ice label with a magic marker or pen.

- The shipper and recipient markings are satisfied when the self-adhesive FedEx Express electronic shipping label has this information preprinted on it.

New Minimum Marking Sizes

- Package capacity > (greater than) 30 KG
  - requires 12 mm type or larger for UN 1845
- Package capacity > 5 KG up to 30 KG
  - requires 6 mm type or larger for UN 1845
- Package capacity < (less than) 5 KG
  - requires the package marking UN 1845 to be of adequate size
- Other package markings and overpack used markings should be 12 mm or larger if package capacity is greater than 30 kg, 6 mm or larger for package capacity at 30 kg or less.

UN 1845 (12 mm)

UN 1845 (6mm)

NOTE: If using a Dry Ice label with preprinted UN number, please handwrite the UN number to ensure appropriate marking size for package capacity.

Acceptable as Shipper and Recipient Markings:

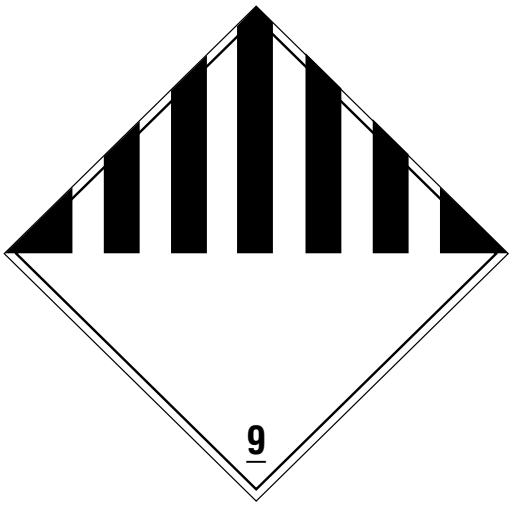
- Addresses completed on the FedEx Express Dry Ice label.
- FedEx Ship Manager® self-adhesive electronic shipping label (with both addresses) placed directly on the package.
- Peel-and-stick FedEx Express Package US Airbill attached directly to the package.
- Package durably marked with both addresses with a magic marker or pen.
- Separate self-adhesive label(s) with addresses handwritten or typed/computer generated.
- A piece of paper with both addresses taped to the package with clear package tape. Entire surface of the paper must be taped.

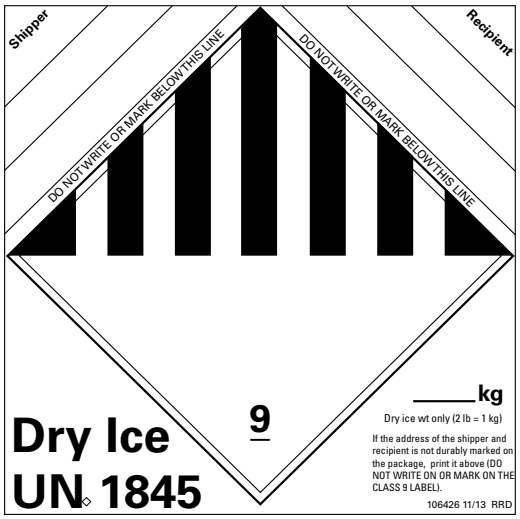
Unacceptable as Shipper and Recipient Markings:

- A paper airbill or sheet of paper from a FedEx electronic shipping device attached to the package in a pouch.
- A FedEx Ship Manager electronic shipping label attached to the package in a pouch, or placed on top of a pouch.

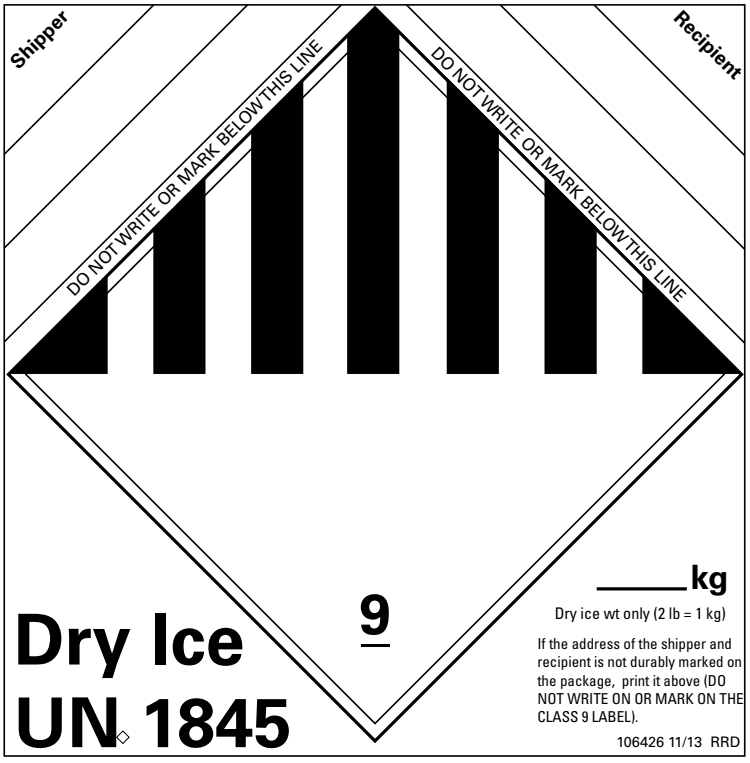
3. Label

- A Class 9 label is required. Do NOT write inside the diamond border of the label.
- The label may be attached to the package by means of a strong tag.
- Special FedEx Express Dry Ice labels are available free of charge by calling 1.800.GoFedEx 1.800.463.3339. These labels greatly simplify the marking and labeling process.
- Part# 167095 (Package of 50 labels)
- Part# 106426 (Roll of 250 labels)



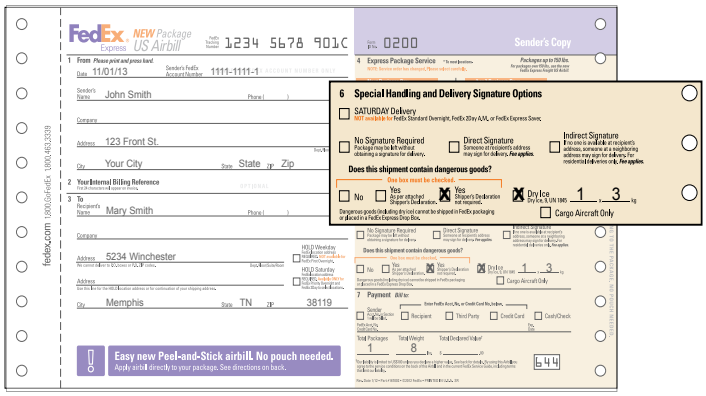


Note: the labels have SEVEN vertical stripes.



4. Prepare Paperwork and Complete Final Steps

- The following are required airbill entries for shipments of dry ice when refrigerating non-dangerous goods:
  - ~ If a paper airbill is used, check "Yes, Shipper's Declaration NOT Required."
  - ~ UN 1845, Dry Ice, ___ x ___kg (where the first blank is the number of packages and the 2nd blank is net quantity in kilograms)
  - ~ When FedEx Ship Manager electronic shipping software is used, this information is entered on-screen and prints on the thermal label.
- Ensure all the required DG markings and labels are not obscured by opaque tape or tape with company logos, pouches, or labels (including service labels).
- To schedule pickups, find drop-off locations for dry ice, or to get rates, call 1.800.GoFedEx 1.800.463.3339.



Helpful Resources

- To purchase the current calendar year International Air Transport Association (IATA) DG regulations go to www.iata.org
- The following URL is for the Perishable chapter of the FedEx "How to Pack" brochure: **images.fedex.com/us/services/pdf/packaging/Perishables_fxcom.pdf**
- If you have questions about the requirements for your dry ice shipment, call the FedEx Dangerous Goods/ Hazardous Materials hotline at 1.800.GoFedEx 1.800.463.3339, and press "81" or say "dangerous goods," then press "4" to reach the next available DG Agent.

STANDARD OPERATING PROCEDURE
HORIZONTAL AND VERTICAL SURVEY CONTROL

Introduction

This Standard Operating Procedure (SOP) has been developed for the Pre-Remedial Design Sampling and Baseline Investigations (PDI) at the Portland Harbor Superfund Site located in Portland, Oregon to confirm accurate positioning of vessels and samples during sample collection activities. The survey control requirements described in this SOP are specifically for environmental sample collection and will generally comply with map-grade precision and accuracy in contrast to the geodetic-grade precision and accuracy performed for the Bathymetric Survey conducted by David Evans and Associates (DEA). However, the same survey control points and geodetic parameters will be used in both surveys for consistency, and a portion of the quality assurance/quality control (QA/QC) process will involve consultation with DEA Oregon Professional Land Surveyor (PLS) staff to review the map-grade data collected for the environmental sample collection.

The organization of this SOP is as follows:

- Methodology Overview
- Project Geodetic Parameters
- Survey Accuracy, Precision, and Control
- Primary Equipment
- Hand-Held GPS Operation
- Vessel Navigation and Equipment Operation
- Data Processing and QA/QC Procedures

Tables, figures, and attachments are presented at the end of the SOP.

Methodology Overview

Horizontal (Map) Data Collection

A combination of vessel-mounted and hand-held GPS receivers will be used to navigate to sampling locations and to collect map location coordinates (Northings, Eastings) for those sampling locations. The vessel-mounted GPS receivers will be the primary tool used for navigation to the pre-planned sampling locations in a GIS file, which will be pre-loaded into the vessel navigational system. The hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or if there is no specific vessel navigation system (i.e., smaller boats). Since the inception of field work, the vessel GPS coordinates have been consistently verified and deemed to be sufficient to meet position and accuracy requirements for the project. The hand-held GPS devices will primarily be used for studies involving small vessels. These devices will also have the pre-loaded basemap content depicting planned sampling locations.

The vessel GPS will operate in two modes, collecting both a separate continuous data stream of positional information (line file) and recording GPS soundings (target file) when a sample is specifically collected. The sample location target file will be recorded when the sampling device is in position for the grab (e.g., when sampler is on the river bottom). The specific Location ID associated with the sample will also be recorded in the GPS device log. Field personnel will be required to write that same Location ID on their field data collection forms at the same time. Both the continuous and episodic dataset will be timestamped to allow comparison of the two types of data. This data will be recorded and maintained on the vessel, and will also be exported from the vessel navigation system and archived to project servers on a daily basis.

The hand-held GPS devices will be operated independently of the vessel's systems and will be used to record a location sounding wherever a sample is collected only for studies unable to use the vessel GPS navigation system. The sample location sounding will be recorded approximately at the same time as when the vessel GPS measurement is collected (e.g., when sampler is in position). The specific Location ID associated with the sample will also be recorded on the GPS device. Field personnel will write this Location ID on the field forms only if the vessel measurement described earlier cannot be collected for some reason (e.g., equipment failure). These measurements will also be timestamped. The data from the hand-held GPS devices will be wirelessly synchronized to a "cloud" web service in near real-time; the data from the "cloud" will also downloaded and saved to project servers daily.

Vertical Data Collection

Vertical (elevation) data is also required for water levels, sample collection depth below surface water, and bottom (mudline) depth location for some types of sample locations. For increased precision and accuracy, it is proposed that bottom (mudline) depth locations (e.g., for sediment cores) be calculated from the 2018 bathymetric surface to be developed by the hydrographic survey performed by DEA (since the data will be collected within a few months of each other). The NAVD88 elevation will be calculated from the intersection of the surface map location coordinates collected as described earlier, projected vertically down to the bathymetric surface (United States Army Corps of Engineers [USACE], 2004). The elevation from the intersection of the bathymetric surface will be used as the final or "best" elevation for the sample.

In contrast, for depth measurements that require less precision (e.g., water levels, depth to samples below water surface), the onboard vessel sonar will be used to record depth and then subsequently calculate elevation. All depths will be recorded relative to the water surface and time tagged to correct with time tagged gauge data for obtaining riverbed elevations. The elevation will be calculated to NAVD88 datum (in feet). To correct elevations, gauge data from the Northwest River Forecast Center will be downloaded for gauge PRT03, which is representative of the former Morrison gauge which has been moved. This gauge does not report NAVD88 elevations but rather reports a value that is 0.3 feet above Columbia River Datum (CRD). Corrections from CRD to NAVD88 differ moving down the river from the gauge due to the fact that NAVD88 is a reference normal to gravity (water does not flow if the elevation is unchanging), and CRD is a gradient datum that follows the lower water surface. In Portland Harbor, the difference between CRD and NAVD88 (Geoid12b) ranges from 0.00 feet CRD = -5.16 feet NAVD88 (Geoid12b) at Willamette River river mile (RM) 2.0, to 0.00 feet CRD = -5.41

feet NAVD88 (Geoid12b) at Willamette River RM 12.8 (approximate location of PRT03 Gauge). Accordingly, a correction to the Willamette Gauge in Portland would be -5.41+0.3 or -5.11 feet at RM 12.8. An approximation would be to subtract 5 feet from the gauge reading for the full length of the study area, but precision will vary depending on tides and river gradient.

For sample locations requiring vertical information, depth will be recorded by field staff on their data collection forms relative to the water surface, and these values will be loaded to the project database as described in the Data Quality Management Plan (DQMP). Final calculated NAVD88 elevation data (feet) will also be entered into a separate data field in the project database after completion of spatial analysis, calculations, and QA/QC. DEA will provide support during the QA/QC process to verify proper calculation of NAVD88 elevation data.

Location Position Recording in Project Database

Discrete Samples

When discrete samples are collected, the Location ID and the location coordinates (Northing/Easting) will be recorded on the GPS device(s) and the field data collection form(s). The location coordinates will be based on the vessel GPS instantaneous target measurement. This target measurement will be the location coordinate pair loaded initially to the project database. After the field event is completed, the target measurement will be compared to the line file (vessel continuous GPS measurement) to confirm that the coordinate pair loaded to the project database is appropriate. If analysis reveals precision or accuracy issues, the loaded location coordinate pair in the project database may be updated and edited with a better value derived from the line file. In general, the hand-held GPS devices will be used as a backup and confirmation of vessel position only if there are problems with the vessel GPS navigation system or an independent navigation system is not available on the vessel. These coordinates will be loaded to the project database only if there is a significant problem with the vessel GPS (e.g., equipment failure) or if there is no vessel GPS.

Composite Samples

When composite samples are collected, location coordinates will also be recorded as both target measurements and continuous measurements using the vessel GPS. The continuous GPS measurements will be recorded during the entire compositing event, and instantaneous target measurements will be collected when the sampler is in position for each individual composite grab. At each compositing location, a target measurement will be recorded in the vessel GPS along with the Location ID with an "a," "b," or "c" suffix. These measurements will be recorded on the field forms in the same manner (e.g., there will be three sets of location coordinates, lithologic descriptions, etc.).

When the location data is loaded to the project database, a single set of location coordinates will be recorded in the project database with a Location ID that excludes the "a," "b," or "c" suffix. As a presumed middle time point, the "b" set of coordinates will be loaded with the primary Location ID to the project database. After the field event is completed, the target measurement associated with the "b" location composite will be compared to the line file (vessel continuous GPS measurement) to assess vessel position and the timeframe of the entire sampling event to confirm if the coordinate pair loaded to the project database is appropriate. The goal will be to finalize the location coordinate information in the project database based on the most representative position based on this analysis. Similar to

discrete sample collection, a hand-held GPS device and related data will only be loaded to the project database if there is a significant problem with operation of the vessel GPS or if the vessel does not have a GPS.

Finally, after field data are collected and surveys are completed, as defined in the DQMP, the location coordinate data will be joined with the tabular data collected by the field teams and loaded to the project database.

Project Geodetic Parameters

The geodetic parameters to be used for the PDI field studies will be as follows:

Horizontal Datum: North American Datum of 1983 (2011)
Projection: State Plane Coordinate System (SPCS) Oregon North Zone
Vertical Datum: North American Vertical Datum of 1988 (NAVD88) Geoid12b
Horizontal Units: International Feet
Vertical Units: Feet

Survey Accuracy, Precision, and Control

The anticipated horizontal accuracy of environmental sampling associated with vessel and hand-held GPS devices is a range of 1 to 5 meters (target 1 to 2 meters for the DGPS unit itself). This should be consistent with RI target accuracy (Integral 2002) and best practices (Puget Sound Estuary Protocols [PSEP] 1998 and US Environmental Protection Agency [EPA] 2008).

The anticipated vertical accuracy of final elevation calculations derived from vessel sonar systems is anticipated to be 1.0 meter.

Table 1 summarizes the survey control locations used in the DEA Bathymetric Survey, which will be used for the environment sample collection work described in this SOP. Figure 1 shows the PH2 piling at the Fred Devine boat dock, and Figure 2 shows the approximate locations of the survey control references for PH1 and PH2. Figure 3 shows approximate location of PH3 for survey control above the Willamette Falls. Attachment 1 contains detailed survey sheets of the following control points: Raindeer, PH1 and PH2, and PH3. Additional information regarding the DEMSI and 2100 control points is available upon request.

Primary Equipment

- Trimble® SPS 461 GPS with dual antennas (vessel GPS)
- A-frame assembly, sampling winch (vessel boom)
- Trimble® R1 (hand held GPS), tethered to Bluetooth® capable smartphone or tablet, ESRI Collector software with Trimble® GNSS Status middleware
- GPS owner's manual
- Writing tools (pencils, Sharpie®)

- Field logbook
- Spare batteries and/or battery charger
- Compass
- Tape measure

Hand-Held GPS Operations

For ease of use, the project team will utilize smartphones tethered to the Trimble® R1 GNSS Receiver via a Bluetooth® connection. The smartphone will be configured with Trimble's middleware software called GNSS Status to convert and stream NMEA satellite data to the smartphone for real-time correction and display to a simple electronic data collection form developed on the ESRI Collector platform. The form will contain a limited number of data fields, including location, study name and operator, date, and notes or comments. This form is not intended to duplicate the content and scope of the field data collection forms, but rather clearly link the GPS data to those forms via the unique Location ID. There are metadata fields available as well from these GPS records, such as estimated horizontal accuracy.

Collected data recorded onto the phone will be transmitted wirelessly via a synchronization process invoked when data is "saved" to the device. The data will be pushed to AECOM Online's Portal and ArcGIS Server for storage of "corrected" location coordinates, Location ID, and other information captured when the GPS sounding is recorded. The sampling event will be trackable in near-real-time as samples are collected on the ArcGIS Portal Interface. Either dedicated, experienced GPS-operators will be collecting the measurements on the smartphones, or, due to the very simple nature of the interface, field personnel will be trained to use the devices. Initial training sessions were already successfully conducted March 19-20, 2018 on use of the smartphone GPS interface. These handheld devices were successfully used for the first 2 weeks of field work. For some studies, such as the smallmouth bass tracking study, these handhelds may be used as the primary GPS due to smaller vessel configuration.

Vessel Navigation and Equipment Operation

Vessel positioning will be conducted through the marine navigation and hydrographic software package HYPACK. This software package allows the visualization of the vessel over navigable charts, the processing of satellite corrections, stored hardware, and vessel parameters, as well as the storing of physical target locations during sampling activities. HYPACK version 2017 will be used for this project.

Vessel position is measured using a Trimble SPS 461 GPS dual antenna receiver. The dual antennas provide precise vessel positioning via both satellite and differential radio corrections along with heading correction to 0.09 degree. GPS data is output through a serial connection into computer running the HYPACK software, for vessel positioning and target collection.

At each sampling location, depth to mudline will be measured using an onboard fathometer (with lead line as confirmation as needed) immediately prior to or during the sampling. Water depths are measured at each station using an Airmar ss510 survey sonar at the sampling point and confirmed daily with a lead line with reference to water surface. Vertical measurements will be recorded to the

nearest 0.1 foot. Water depths will be converted to elevations in NAVD88 based on the river stage at the time of sampling as recorded at the closest available tide gage.

Data Processing and QA/QC Procedures

All GPS devices will be subject to a position check to confirm the accuracy of the on-vessel GPS and hand-held GPS devices and to validate the positions derived from each GPS receiver. Correctors will be applied as needed, resulting in a position that is within specified positioning accuracy of the DEA published position for control monuments PH1, PH2, and PH3 (or future control point approved by EPA). At the start and end of each field day, the benchmark location will be visited to perform a position check.

At the piling serving as the PH2 control monument (accessible by boat), the on-vessel GPS calibrated to the top of A-frame assembly will be maneuvered as close to the benchmark piling as possible to record a point. The GPS-derived position of the sampling vessel is compared with the known horizontal location; results will be recorded in HYPACK to confirm that accuracy is within +/- 2 meters.

For handheld GPS, field staff will occupy the PH1 at the Swan Island boat launch parking lot or PH3 at the Willamette Park boat launch. Using the R1 and phone/tablet combination GPS setup, the field staff will hold the R1 above PH1 or PH3 and wait for a satellite "fix," and when ready, the staff will record the GPS location in Collector. This GPS location will be compared to the known coordinates to confirm the accuracy is within +/- 2 meters. The survey control monuments act as a known location to allow for corrected station location coordinates during post-processing of data as needed. If a need arises to locate another benchmark, there are several USGS control points near the project area and near the AECOM project warehouse. Experienced GPS operators on the project team will be involved in all aspects of field data collection events to troubleshoot devices and assist in daily review of extracted geospatial datasets. Additional details on QA/QC procedures can be found on the DQMP.

References

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. 22 February.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. June 14.

EPA (United States Environmental Protection Agency). 2008. National Geospatial Data Policy. August 24.

PSEP. 1998. Recommended Guidelines for Station Positioning in Puget Sound. Prepared for United States EPA Region 10 and the Puget Sound Water Quality Action Team. September.

USACE (United States Army Corps of Engineers). 2004. Engineering and Design Hydrographic Surveying Manual, EM 1110-2-1003, U.S. Army Corps of Engineers, April 2004

Tables and Figures

Attachments

Detailed survey sheets of PH Control Points of Portland Harbor (PH1, PH2, and PH3), and Raindeer survey monuments

Table 1. Benchmark Monument Coordinates and Description

Designation	Approx. Location	Description	NAD83 (2011), Oregon SPCS North (ft)		NAVD88 Elevation (ft)
			Northing	Easting	
DEMSI-BASE	Columbia River	Fixed antenna with height at antenna reference point	718172.70	7654431.05	73.58
DEMSI- CHECK	Columbia River	Fixed antenna with height at antenna reference point	718170.73	7654419.84	71.67
RAINDEER	RM 2	USACE Brass Cap	722443.24	7614886.64	35.44
Portland Harbor 1 (PH1)	Swan Island Boat Ramp	1/2" Iron Rod with red plastic cap stamped "DEA Control" Point is 0.3 feet south of the back of curb at the Swan Island Boat Ramp, 10.5 feet north of a cyclone fence, and 60 feet east of a light post	698702.46	7637426.37	33.38
Portland Harbor 2 (PH2)	Fred Devine Boat Dock	Reference point is 0.2 feet SE of the SE side of a 1-1/2-foot diameter steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon.	700967.87	7634507.67	NA
Portland Harbor 3 (PH3)	Willamette Park Boat Launch (above the falls)	PK nail in trailer parking lot of boat launch ramp, near center of loop and approximately even with seventh parking space.	617123.76	7649701.80	72.42
2100	RM 13	5/8" bolt on SW corner of screen wall at DEA office 2100 SW River Parkway, Portland, OR	678400.01	7645190.81	159.51

General Notes:

1. The two DEMSI and the 2100 stations (indicated with green shading) are transceiver beacon stations in upland areas. These stations will not be used for daily location control checks by sampling team. More information regarding these stations is available upon request.
2. PH1 is located at the Swan Island boat ramp parking lot and accessible by foot.
3. PH2 is located at a piling at the boat dock where project-related vessels will be docked and is accessible by boat. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
4. PH3 is located in the parking lot of the boat launch above the Willamette Falls and is accessible by foot.
5. Raindeer station is located adjacent to the river and accessible by foot (for the hand-held GPS).

Acronyms:
DEA = David Evans and Associates; ft = feet; NAD83 = North American Datum of 1983; NAVD88 = North American Vertical Datum of 1988; PH = Portland Harbor; RM = river mile; PK nail = survey marker; USACE = US Army Corps of Engineers; SPCS = State Plane Coordinate System

Figure 1. Photograph of Piling PH2, at the end of the Fred Devine Boat Dock. Piling was surveyed during and captured in DEA bathymetric survey. Photo is facing northwest.

PH2 is located on the SE corner of the Fred Devine Boat Dock, where Gravity's boats berth every night.

PH1 is located on the SW side of the Swan Island Boat Launch parking lot, where field crews park to meet the boats at the launch dock.

Figure 2. Locations of control monuments PH1 and PH2 at Swan Island Boat Launch and Fred Devine Boat Dock, respectively.

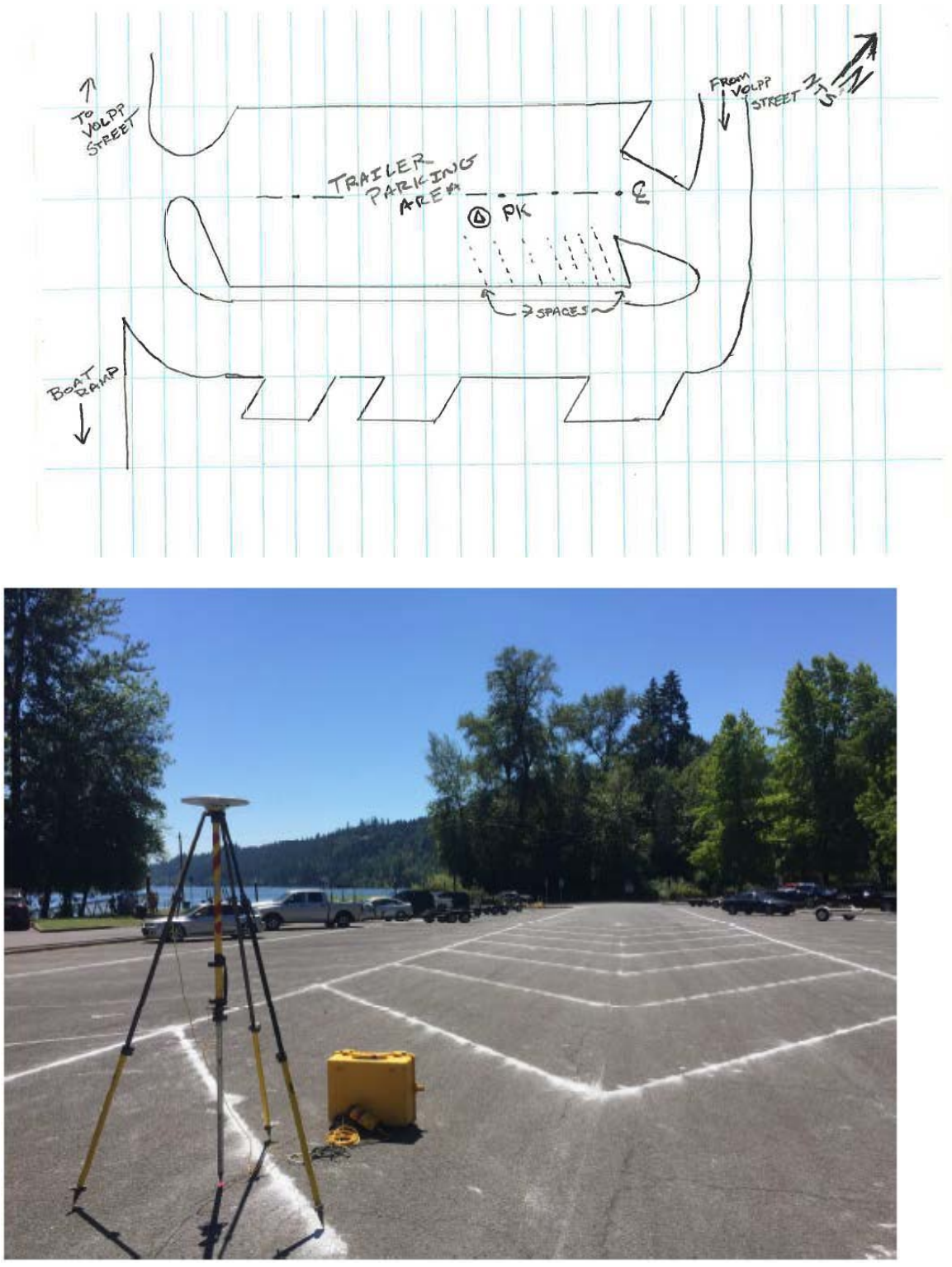


Figure 3. PK nail in the middle of Willamette Park Boat Launch parking marks survey monument PH3. It was land-surveyed by DEA and marked with pink survey tape. Photo shows survey equipment set-up over PH3.

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 1 (PH1)		Station PID, if any:	Date (UTC): 06-Mar-18
General Location: Swan Island Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 065
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ‘ “	NAD83 Longitude o ‘ “	NAD83 Ellipsoidal Height meters NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Agency Full Name: David Evans and Associate, Inc. Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:30 Stop 21:32	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees		

Receiver Brand & Model: Trimble SPS985
82500-60
P/N:
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked 10 meters N (direction) from antenna.

Antenna plumb before session?	(Y / N)	Circle
Antenna plumb after session?	(Y / N)	Yes or No
Antenna oriented to true North?	(Y / N) ✓	-If no,
Weather observed at antenna ht.	(Y / N) ✓	explain
Antenna ground plane used?	(Y / N) ✓	“
Antenna radome used?	(Y / N) ✓	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N) ✓	describe.
Any obstructions above 10°?	(Y / N) ✓	Use
Radio interference source nearby	(Y / N) ✓	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

**** ANTENNA HEIGHT ****

	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height **= A + B** = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	19:30							
Middle									
After	00000	21:32							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Control point is a 1/2" iron rod with red plastic cap stamped "DEA CONTROL" set 0.1' below natural grade. Control point is 0.3' south of the back of curb, 10.5' north of a cyclone fence and 60' easterly of the 2nd light post east of the boat ramp. See detached sketch and photos.

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 95100650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description:	❒ Attached	❒ Submitted earlier
Visibility Obstruction Form:	❒ Attached	❒ Submitted earlier
Photographs of Station:	✓ Attached	❒ Submitted earlier
Pencil Rubbing of Mark:	❒ Attached	

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Sketch of Monument PH1

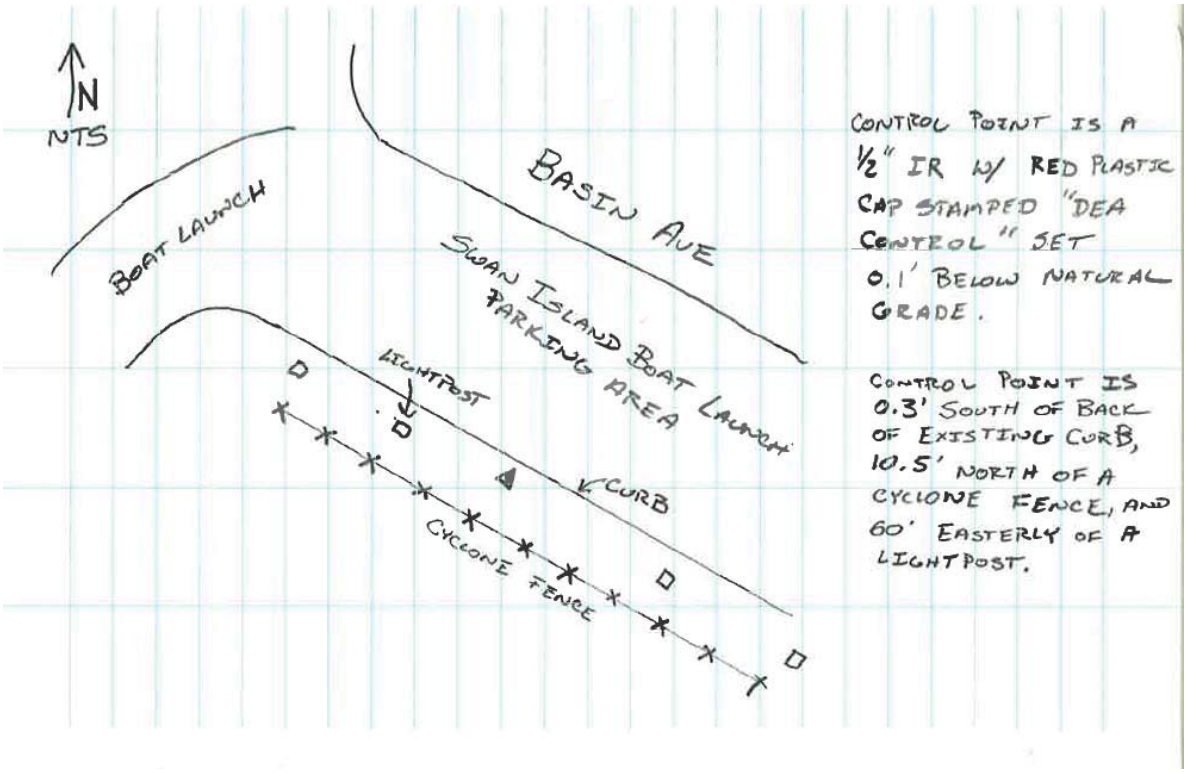


Photo of Monument PH1

GNSS Setup on PH1

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM) Portland Harbor 2 (PH2)		Station PID, if any:	Date (UTC): 20-Apr-18
General Location: Fred Devine Boat Dock	Airport ID, if any:	Station 4-Character ID:	Day of Year: 111
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude o ‘ “	NAD83 Longitude o ‘ “	NAD83 Ellipsoidal Height meters NAVD88 Orthometric Ht. meters GEOID99 Geoid Height meters	Agency Full Name: David Evans and Associate, Inc. Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com
Observation Session Times (UTC): Sched. Start _____ Stop _____ Actual Start 19:45 Stop 19:49	Epoch Interval= 1 Seconds Elevation Mask = 10 Degrees		

Receiver Brand & Model: Trimble SPS985
82500-60
P/N:
S/N: 5616F59510
Firmware Version: 5.30
❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ✓ Other

Antenna Code*, Brand & Model: Trimble SPS985 Internal
P/N:
S/N:
Cable Length, meters: n/a
Vehicle is Parked n/a meters ____(direction) from antenna.

Antenna plumb before session?	(Y / N) ✓	Circle
Antenna plumb after session?	(Y / N) ✓	Yes or No
Antenna oriented to true North?	(Y / N) ✓	-If no,
Weather observed at antenna ht.	(Y / N) ✓	explain
Antenna ground plane used?	(Y / N) ✓	“
Antenna radome used?	(Y / N) ✓	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N) ✓	describe.
Any obstructions above 10°?	(Y / N) ✓	Use
Radio interference source nearby	(Y / N) ✓	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

**** ANTENNA HEIGHT ****

	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
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H= Antenna Height **= A + B** = Datum Point to Antenna Reference Point (ARP)	2.000	6.56	2.000	6.56

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00010	19:45							
Middle									
After	00010	19:49							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Reference point is 0.2 feet SE of the SE side of a 1-1/2 foot steel pile. This is the furthest SE pile at the end of the Fred Devine Diving and Salvage Company dock in the Swan Island Lagoon. This pile is to be used for daily position checks for sediment sampling operations. Pile is for position only and not elevation.
NAD83(2011) Oregon North Zone International Feet Coordinates
North 700967.9 East 7634507.7

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s):
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description:	❒ Attached	❒ Submitted earlier
Visibility Obstruction Form:	❒ Attached	❒ Submitted earlier
Photographs of Station:	✓ Attached	❒ Submitted earlier
Pencil Rubbing of Mark:	❒ Attached	

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
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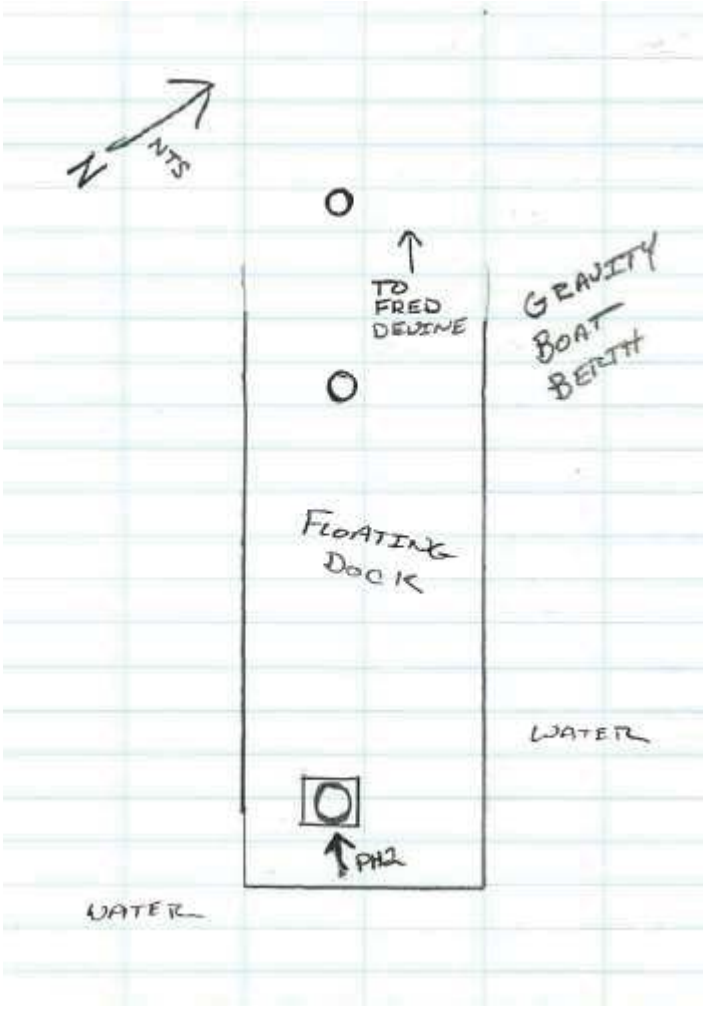
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Sketch and Fieldnotes



200 CHK PH1

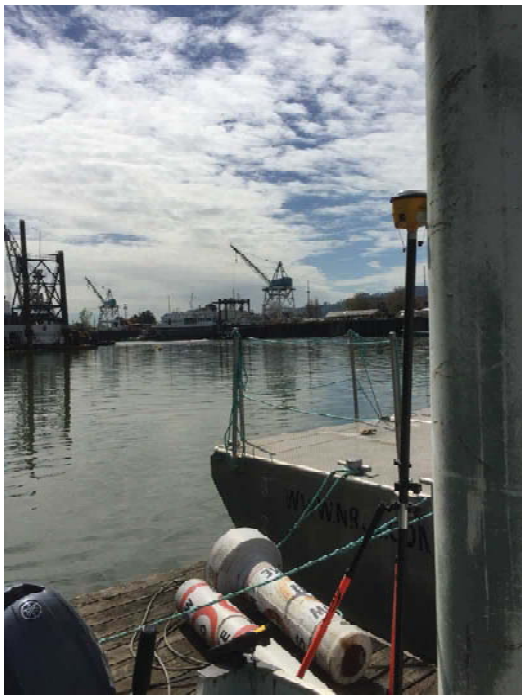
	KNOWN COORDS	OBS	Δ (FT)
N	698702.46	698702.45	0.01
E	7637426.37	7637426.39	0.02
Z	33.38	33.37	0.01

201 SE FACE OF PILE
3-MIN OBS
N = 700967.87
E = 7634507.64
Z = N/A

202 SW FACE TOPO
203 NW FACE TOPO
204 NE FACE TOPO

Overview of PH2 Pile

GNSS Setup on PH2 Pile



View facing south

View facing northwest

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

--> Click here to clear the sample data <--

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable: __ FBN __ CBN __ PAC __ SAC __ BM) Portland Harbor 3 (PH3)		Station PID, if any:	Date (UTC): 24-Jul-18
General Location: Willamette Park Boat Launch	Airport ID, if any:	Station 4-Character ID:	Day of Year: 205
Project Name: Portland Harbor - AETR00000034	Project Number: GPS-	Station Serial # (SSN):	Session ID:(A,B,C etc)

NAD83 Latitude: N45° 20' 21.30094"	NAD83 Longitude: W122° 38' 54.96637"	NAD83 Ellipsoidal Height: -0.752 meters NAVD88 Orthometric Ht.: 22.073 meters GEOID99 Geoid Height: meters	Agency Full Name: David Evans and Associate, Inc. Operator Full Name: David T. Moehl Phone #: ( ) (360) 314-3200 e-mail address: dtm@deainc.com

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 20:55 Stop 22:58

Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Receiver Brand & Model: Trimble NetR5 P/N: 62800-10 S/N: 4750K11589 Firmware Version: 48.01 ❒ CamCorder Battery, ❒ 12V DC, ❒ 110V AC, ❒ Other	Antenna Code*, Brand & Model: Zephyr 3 Base P/N: 115000-10 S/N: 3121179869 Cable Length, meters: 5 Vehicle is Parked 10 meters E (direction) from antenna.	Antenna plumb before session? (Y / N) ✓ Circle Antenna plumb after session? (Y / N) ✓ Yes or No Antenna oriented to true North? (Y / N) ✓ -If no, Weather observed at antenna ht. (Y / N) ✓ explain Antenna ground plane used? (Y / N) ✓ " Antenna radome used? (Y / N) ✓ If yes, Eccentric occupation (>0.5 mm)? (Y / N) ✓ describe. Any obstructions above 10°? (Y / N) Use Radio interference source nearby (Y / N) Vis. form

Tripod or Antenna Mount: Check one:
❒ Fixed-Leg Tripod, ✓ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco Collapsible
P/N:
S/N: uk
Last Adjustment date: 2018-07-24

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

**** ANTENNA HEIGHT ****

	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.003		2.003	
B= Additional offset to ARP if any (Tribrach/Spacer)	0.000		0.000	
H= Antenna Height **= A + B** = Datum Point to Antenna Reference Point (ARP)	2.003	6.57	2.003	6.57

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00100	20:50							
Middle									
After	00100	23:00							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Calculate

Control point is a PK nail with pink flagging in the trailer parking lot of the Willamette Park boat ramp. Control point is between the trailer parking and assumed centerline of the loop and approximately even with the seventh parking place on the east side of the parking lot. See detached sketch and photos.
NAD83(2011) Oregon North Zone Coordinates, International Feet
North 617123.76' East 7649701.80' Elevation 72.42' NAVD88(Geoid12b)

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 15892050.18o
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description: ❒ Attached ❒ Submitted earlier
Visibility Obstruction Form: ❒ Attached ❒ Submitted earlier
Photographs of Station: ✓ Attached ❒ Submitted earlier
Pencil Rubbing of Mark: ❒ Attached

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Sketch of Monument PH3

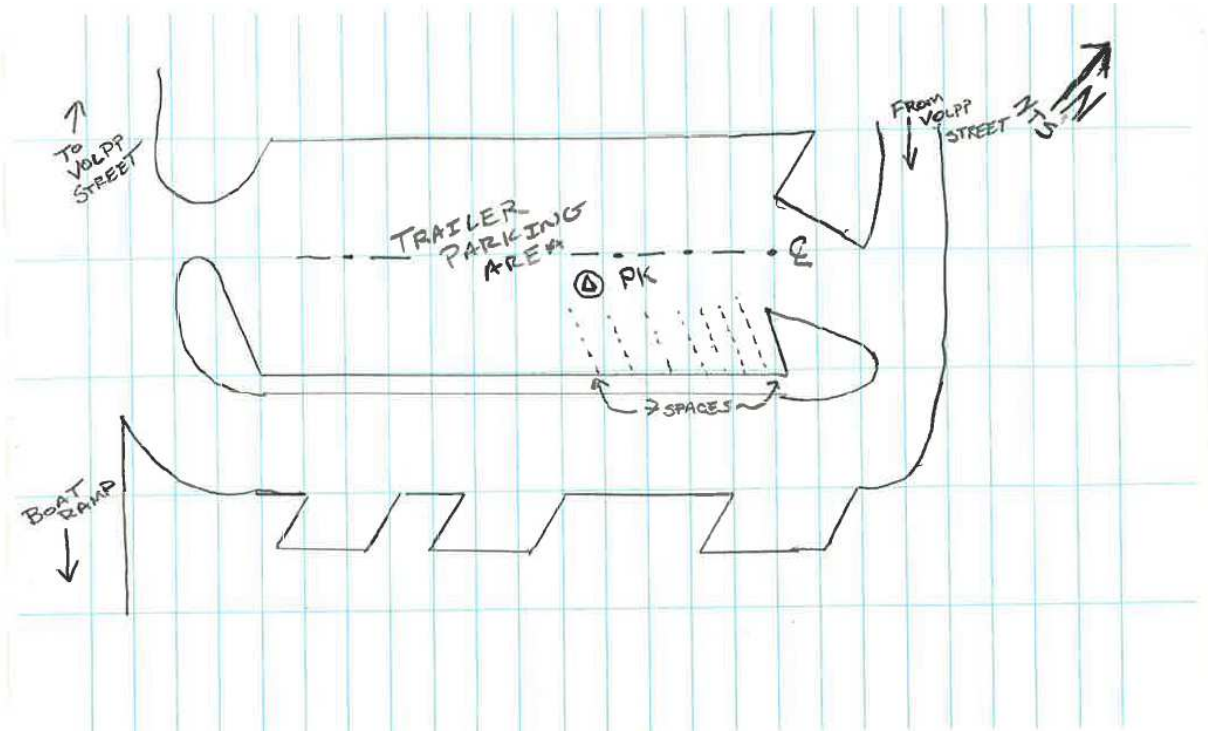


Photo of Monument PH3

GNSS Setup on PH3

NOTE: This form intended for field use. Unsolicited data submitted to NGS must be converted to bluebook format.

GPS STATION OBSERVATION LOG
April 16, 2003

Station Designation: (check applicable:__ FBN__ CBN__ PAC__ SAC __BM)	Station PID, if any:	Date (UTC):
Raindeer		06-Mar-18
General Location: Sauvie Island, Willamette River	**Airport ID, if any:**	**Station 4-Character ID:** / **Day of Year:** 065
Project Name: Portland Harbor - AETR00000034	**Project Number:** GPS-	**Station Serial # (SSN):** / **Session ID:(A,B,C etc)**

NAD83 Latitude	NAD83 Longitude	NAD83 Ellipsoidal Height
o ‘ “	o ‘ “	meters
		NAVD88 Orthometric Ht. meters
		GEOID99 Geoid Height meters

Observation Session Times (UTC):
Sched. Start _____ Stop _____
Actual Start 17:38 Stop 23:45
Epoch Interval= 1 Seconds
Elevation Mask = 10 Degrees

Agency Full Name: David Evans and Associates, Inc.
Operator Full Name: David T. Moehl
Phone #: ( ) (360) 314-3200
e-mail address: dtm@deainc.com

Receiver Brand & Model: Trimble SPS855
P/N: 69855-60
S/N: 5506R0074
Firmware Version: 5.30
❒ CamCorder Battery, ✓ 12V DC, ❒ 110V AC, ❒ Other

Antenna Code*, Brand & Model: Trimble Zephyr 3 Base
P/N: 115000-00
S/N: 1551129193
Cable Length, meters: 10
Vehicle is Parked n/a meters ____(direction) from antenna.

Antenna plumb before session?	(Y / N)	Circle
Antenna plumb after session?	(Y / N)	Yes or No
Antenna oriented to true North?	(Y / N)	-If no,
Weather observed at antenna ht.	(Y / N)	explain
Antenna ground plane used?	(Y / N)	“
Antenna radome used?	(Y / N)	If yes,
Eccentric occupation (>0.5 mm)?	(Y / N)	describe.
Any obstructions above 10°?	(Y / N)	Use
Radio interference source nearby	(Y / N)	Vis. form

Tripod or Antenna Mount: Check one:
✓ Fixed-Leg Tripod, ❒ Collapsible-leg tripod ❒ Fixed Mount
Brand & Model: Seco fixed height
P/N:
S/N: 5115-00-FLY
Last Adjustment date: 2018-03-05

Psychrometer (if used) Brand & Model:
P/N:
S/N:
Last Calibration or check Date:

**** ANTENNA HEIGHT ****

	Before Session Begins: Meters	Feet	After Session Ends: Meters	Feet
A= Datum point to Top of Tripod (Tripod Height)	2.000		2.000	
B= Additional offset to ARP if any (Tribrach/Spacer)	-0.003		-0.003	
H= Antenna Height **= A + B** = Datum Point to Antenna Reference Point (ARP)	1.997	6.55	1.997	6.55

Meters = Feet x (0.3048)
Height Entered Into Receiver = 2.000 meters.
Note &/or sketch **ANY** unusual conditions. Be **Very Explicit** as to where and how Measured!

Barometer (if used) Brand & Model:
S/N:

Weather Data	Weather Codes	Time (UTC)	Dry-Bulb Temp Fahrenheit	Dry-Bulb Temp Celsius	WetBulb Temp Fahrenheit	WetBulb Temp Celsius	Rel. % Humidity	Atm. Pressure inches Hg	Atm. Pressure millibar
Before	00000	17:38							
Middle									
After	00000	23:45							

Remarks, Comments on Problems, Sketches, Pencil Rubbing, etc:

Weather codes are required. Weather data are optional but encouraged. *Antenna code comes from ant_info file furnished by project coordinator.

Data File Name(s): 00740650.T02
(Standard NGS Format = aaaaddds.xxx)
where aaaa=4-Character ID, ddd=Day of Year, s=Session ID, xxx=file dependant extension

Updated Station Description:	❒ Attached	❒ Submitted earlier
Visibility Obstruction Form:	❒ Attached	❒ Submitted earlier
Photographs of Station:	✓ Attached	❒ Submitted earlier
Pencil Rubbing of Mark:	❒ Attached	

LOG CHECKED BY: Jon Dasler

Table of Weather Codes	CODE	PROBLEM	VISIBILITY	TEMPERATURE	CLOUD COVER	WIND
	0	did not occur	Good, over 15 miles	Normal, 32° F- 80° F	Clear, below 20%	Calm, under 5mph (8km/h)
	1	did occur	Fair, 7-15 miles	Hot, over 80°F (27 C)	Cloudy, 20% to 70%	Moderate, 5 to 15 mph
	2	- not used -	Poor, under 7 miles	Cold, below 32° F (0 C)	Overcast, over 70%	Strong, over15 mph (24km/h)
Examples:	00000 = No problem, good visibility, normal temp, clear, calm wind			12121 = Problems, poor visibility, hot, overcast, moderate wind		

Photo of Monument RAINDEER

Photo of Monument RAINDEER

GNSS Setup on RAINDEER

APPENDIX B

Field Forms

EQUIPMENT CALIBRATION LOG

Project Name: Portland Harbor PDI Studies 2018, Study Name:

Field Crew Initials:

Comments:

Circle or Write in Type/Equipment Model	Serial No.	Calibrated By	Date	Time	Parameter Calibrated and Calibration Standard	Calibration/ check Pass Y/N?
scale					zeroing 0 grams of weight initial reading: adjustment: Final reading: check 1 gram of weight: 50 grams of weight: 100 grams of weight:	
freezer					condition of samples (frozen/thawed)? freezer setting? freezer temperature? Adjustment made to temperature sertting?	
refrigerator					condition of samples (frozen/thawed)? refrigerator setting? refrigerator temperature? Adjustment made to temperature sertting?	
other equipment					zeroing units initial reading: adjustment: Final reading: check	

FISHING EFFORT AND TALLY FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Sampling Date	Sampling Location ID (e.g. SMB001)	Angler Initials	Fishing Start Time	Fishing Stop Time	Total Duration (minutes)	Catch Time	Catch Species*	Health	Comments

* Catch Species Abbreviations: BB= brown bullhead, BC= black crappie, BG= bluegill, CC= common carp, LS= largescale sucker, LB= largemouth bass, NP= northern pikeminnow, PS= pumpkinseed, SC= sculpin, SMB= smallmouth bass, WC= white crappie, YP= yellow perch; for ESA species: CHK=Chinook salmon, CM= chum salmon, CO= coho salmon, SWT= steelhead

SMALLMOUTH BASS SPECIMEN TALLY AND LOCATION FORM

Portland Harbor PDI Studies – 2018 Fish Tissue Study or 2018 Fish Tracking Study (circle one)

Field Crew Initials:

Fishing Technique:

Collection Date	Collection Time	Sample ID*	Sample Location ID (e.g. SMB001)	Fork Length (mm)	Total Length (mm)	Weight	Health	Retained for Analysis or Tagging?	Sample Location Depth to Mudline (ft)	X Coordinate Easting (ft)	Y Coordinate Northing (ft)	Comments

*Sample ID nomenclature is as follows: SMB Tissue Study = PDI-TF-SMB001; Acoustic Tracking Study = PDI-AT-SMBT01.

PHOTO LOG

Portland Harbor PDI 2018 Study Name:

Boat Name:

Team Members:

Date and Time	Camera Identifier (type, model, equipment number)	Location ID	Sample ID	Photo ID	Photo Direction	Description	Habitat Condition	Photo Notes and Comments

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