APPENDIX E
WATER QUALITY MONITORING AND SEDIMENT SAMPLING PLAN

WATER QUALITY MONITORING AND SEDIMENT SAMPLING PLAN

PORT OF OLYMPIA WEST BAY BERTHS 2 AND 3

Prepared for

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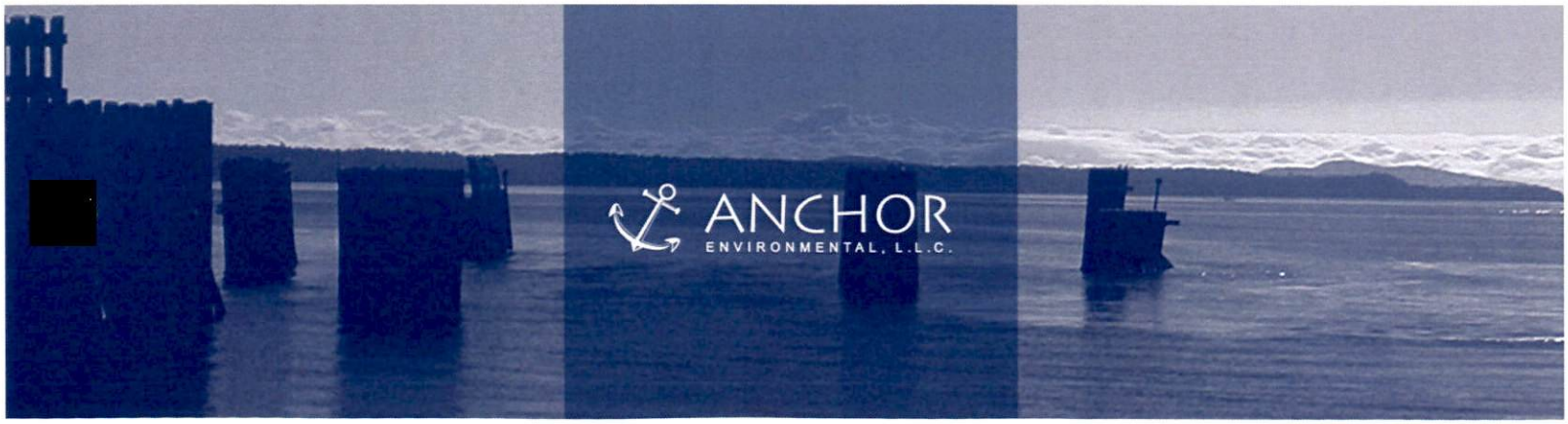

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1 INTRODUCTION

1.1 Background

The Port of Olympia (Port) and Washington State Department of Ecology (Ecology) have entered into an Agreed Order (AO; No. DE 6083, Ecology 2008a) for the Interim Cleanup Action Pilot Study to address sediments adjacent to the Port's Berths 2 and 3 (Figure 1) in South Budd Inlet, Olympia, Washington, and to accomplish maintenance dredging to a minimum of -39 feet below mean lower low water (MLLW). Sediment quality in West Bay and South Budd Inlet is the focus of ongoing investigations by Ecology (SAIC 2007a, SAIC 2007b, and SAIC 2008; e.g., Budd Inlet Sediments Investigation). An Interim Action Plan (IAP; Exhibit C to Ecology 2008a) was developed using information collected as part of the proposed Olympia Harbor Navigation Channel Maintenance Dredging Project and Ecology's Budd Inlet Sediments Investigation, which was prepared to satisfy the requirements of Chapter 70.105D Revised Code of Washington (RCW), administered by Ecology under the Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 Washington Administrative Code (WAC).

The Port's IAP generally involves removal of sediments with elevated chemical concentrations to prevent increased risks to human health or the environment, conducting an Interim Action Pilot Study to collect information on how to investigate and design a more comprehensive cleanup of Port berthing areas in West Bay that will achieve cleanup standards, and removing sediments to maintain a navigational depth of -39 feet MLLW at Berths 2 and 3.

1.2 Sampling Plan Objectives and Document Organization

This Water Quality Monitoring and Sediment Sampling Plan (Sampling Plan) discusses the objectives and functional activities associated with implementing the Sampling Plan, which has been designed to gather information to assess potential water quality impacts during project implementation, confirmatory sediment chemistry sampling and bathymetry following dredging, placement of clean cover, and at additional future intervals. The objectives of the Sampling Plan are to:

- Ensure that water quality conditions are within the prescribed limits required by Ecology and described in this Plan

- Allow for appropriate adjustment of construction activities in a manner that ensures protection of the environment during and after said activities
- Describe the process for documenting the results of the sediment sampling in a Sampling Results Report to submit to Ecology and the U.S. Army Corps of Engineers, Seattle District, Regulatory Branch (Corps).

This Sampling Plan includes:

- Parties responsible for implementing the Sampling Plan (Section 2)
- Field procedures and schedule for conducting the water quality monitoring program (Section 3)
- Responses to address contingency measures that might be used if there are exceedances of water quality criteria (Section 3)
- Field procedures and schedule for conducting the sediment sampling program (Section 4)
- Laboratory preparation and analysis procedures (Section 4)
- Description of final Sampling Results Report documenting findings from implementation of the Sampling Plan (Section 4)
- Post-dredge bathymetry survey (Section 5)

2 PROJECT TEAM AND RESPONSIBILITIES

This section discusses the proposed project team and responsibilities for conducting the West Bay Berths 2 and 3 water quality and sediment confirmatory sampling.

2.1 Project Oversight

Mr. David Templeton of Anchor Environmental, L.L.C. (Anchor), will provide comprehensive project oversight for the sediment characterization and any other considerations associated with planning, dredging, and disposal operations. Mr. Templeton will coordinate, as necessary, with Port personnel to ensure that all quality assurance/quality control (QA/QC) goals for all aspects of the project are met.

2.2 Project Planning and Coordination

Mr. Templeton will be Anchor's on-site Project Manager. He will ensure that staffing and all additional resources for fulfilling Anchor's responsibilities regarding proposed work at the Port are provided. Mr. Templeton will coordinate closely with the Port and Ecology to address any matters regarding the work.

2.3 Field Sample Collection

Mr. Dan Berlin of Anchor will supervise the monitoring stations for water quality monitoring and field collection of the sediment grab samples. Mr. Berlin will be responsible for ensuring accurate positioning and recording of sample locations, depths, and identification; ensuring conformity to sampling and handling requirements, including field decontamination procedures, physical evaluation, and logging the samples; and chain-of-custody of samples until the time the samples are delivered to the analytical laboratory for chemical analysis.

2.4 Laboratory Preparation and Analyses

Ms. Tamara Morgan of Analytical Perspectives (AP) in Wilmington, North Carolina, will be responsible for chemical analyses of dioxin/furans. Ms. Morgan will ensure that the submitted samples are handled and analyzed in accordance with Puget Sound Estuary Program (PSEP) analytical testing protocols, QA/QC requirements, and requirements as

specified in the Sampling Plan. AP will prepare a laboratory report of analytical results and QA/QC procedures.

Ms. Pamela Johnson of TestAmerica (TA) in Tacoma, Washington, will be responsible for physical and conventional chemical analyses. Ms. Johnson will ensure that the submitted samples are handled and analyzed in accordance with PSEP analytical testing protocols, QA/QC requirements, and requirements as specified in the Sampling Plan. TA will prepare a laboratory report of analytical results and QA/QC procedures.

2.5 Quality Assurance/Quality Control Management

Ms. Joy Dunay of Anchor, or her designee, will serve as QA Representative for this project. She will perform QA oversight for both the field sampling and laboratory programs. She will be kept fully informed of field program procedures and progress during sample collection and laboratory activities during sample preparation. She will record and correct any activities that vary from the written Sampling Plan. Upon completion of the Sampling Plan, she will review laboratory QA/QC results and incorporate findings into the final Sampling Results Report. Any QA/QC problems will be brought to the attention of Ecology as soon as possible to discuss issues related to the problem and to evaluate potential solutions.

2.6 Data Management

Ms. Laurel Menoche of Anchor, or her designee, will serve as the data manager for this project. She will be responsible for data submittal to Ecology. All data submittals will be in accordance with Ecology's Toxic Cleanup Program Policy 840 and Subappendix E of the Sediment Sampling and Analysis Plan Appendix (SAPA; Ecology 2008b).

3 WATER QUALITY MONITORING PROGRAM

3.1 Applicable and Relevant Water Quality Standards

The waters for this project are designated as good quality marine waters by the State of Washington (WAC 173-201A). The Port proposes to monitor turbidity and dissolved oxygen as the primary indicators of water quality. For good quality marine water bodies, turbidity shall not exceed 10 nephelometric turbidity units (NTUs) over background turbidity when the background turbidity is 50 NTUs or less, or there shall not be more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTUs. The lowest 1-day minimum for dissolved oxygen in good quality marine water bodies is 5.0 mg/L.

3.2 Monitoring Locations and Depths

The monitoring distances for water quality measurements are on 100 and 150 foot radiuses of the respective activity sites, with 150 feet being the compliance boundary. Each monitoring event will consist of measuring dissolved oxygen and turbidity at three locations on the 100 foot radius, 3 locations on the 150 foot radius, and one background location. Measurements at the 100-foot distance serve as an interim indicator of water quality closer to the site work activity. Elevated measurements at the 100-foot distance might indicate the potential for subsequent exceedance at the compliance boundary, and the "early warning" would allow modification of the operation of the activity to potentially avoid exceedances at the compliance boundary. A description of how the operation will be modified if exceedances are detected at the 100 foot radius or 150 foot radius is described in Sections 3.5.1 and 3.5.2, respectively. The representative background sampling station will be located 1,000 feet up-current from active in-water work in an area unaffected by the active work. The background station may be to the south or the north of the activity area, depending on tidal flows (Figure 2). Figure 2 shows the background sample located to the south during ebb tide and to the north during flood tide.

Figure 2 also shows a radial compliance boundary and a few representative water quality monitoring locations for early warning (100 feet from active in-water work) and compliance measurements (150 feet from active in-water work). The actual positions of early warning, compliance, and background stations will be adjusted in the field using the best professional judgment of the monitoring crew. These adjustments will be based on the location of active

in-water work, the tidal cycle, and observations of the current. The actual positions will be recorded in the field documentation. In addition, the Port will stay in contact with Capital Lake Dam operations to better understand when dam flows may result in elevated total suspended solids (TSS) and turbidity.

Water quality will be in compliance with WAC 173-210A-210. In situ turbidity and dissolved oxygen measurements will be collected at three locations for early warning (along the 100 foot radius) and three compliance locations (along the 150 foot radius) during each monitoring event. The background station will also be sampled during each monitoring event. At each turbidity and dissolved oxygen profiling station (early warning, compliance, and background), turbidity and dissolved oxygen measurements will be made at 3 feet below the water surface, at 3 feet above the bottom, and at the mid-point of the water column. Water depth will be determined using a lead line at the monitoring location, which will be recorded onto the field data log sheet. Sample measurements from each of the three depths will be compared to each of the three corresponding depths at the background station.

3.3 Monitoring Methods and Equipment

In situ turbidity and dissolved oxygen will be measured with a Hydrolab water quality meter (or equivalent) or a turbidometer and dissolved oxygen meter. Turbidity and dissolved oxygen data for each monitoring event and respective location will be recorded on a field data sheet. At the conclusion of each monitoring event, field data sheets and results of the monitoring event will be faxed or emailed to Lisa Pearson at the Department of Ecology, Toxics Cleanup Program at (360) 407-6305.

3.4 Monitoring Frequency and Schedule

The frequency and schedule of the monitoring during the in-water work is divided into three distinct levels as described below:

- *Intensive* – Collection of turbidity and dissolved oxygen measurements every 4 hours during in-water work
- *Routine* – Collection of turbidity and dissolved oxygen measurements once daily during in-water work, or if turbidity plumes become visually evident

- *Limited* – Collection of turbidity and dissolved oxygen measurements only if turbidity plumes are visually evident during in-water work

Monitoring will be conducted on an intensive schedule for the first 3 days of in-water work. If no exceedances occur during the intensive monitoring, monitoring will be reduced to a routine schedule for 3 additional days. If no exceedances occur during routine monitoring, monitoring will be reduced to a limited schedule for the remaining days, unless otherwise required by Ecology. The occurrence of exceedances, visual turbidity observations, or a significant change in construction equipment or operations (e.g., dredging and material placement) will trigger a transition back to intensive monitoring to confirm that no water quality impacts have occurred.

3.5 Responses to Water Quality Exceedances

Some conditions require an immediate stop-work response. These are as follows:

- Evidence of a significant oil sheen
- Evidence of distressed or dying fish
- Confirmed exceedance of water quality criteria at the 150-foot compliance boundary following consultation with Ecology

Additional steps are required in the event of water quality measurements above the turbidity or dissolved oxygen criteria at the 100-foot and 150-foot stations. These steps are discussed in Sections 3.5.1 and 3.5.2.

3.5.1 100 foot Station

If turbidity or dissolved oxygen measurements at the 100-foot "early warning" station are measured above the criterion for good quality marine waters as listed in Section 3.1, the following sequence of responses will be initiated.

1. If an initial exceedance is measured at the 100-foot boundary, the sampler will wait 5 to 10 minutes and retake measurements at the station. Visually assess the station vicinity for potential outside influences, such as storm drains.
2. If water quality passes the turbidity/dissolved oxygen standard, the sampling crew will move to the next station.

3. If the station water quality turbidity or dissolved oxygen standard exceedance is confirmed (two measurements in 5 to 10 minutes), the Port and the contractor will be notified and the contractor will modify their work activity using BMPs. Evaluate the current work to determine if adjustments can be made to correct the problem. Modifications may include implementation of additional best management practices, such as further slowing the speed of the bucket through the water column, avoiding overfilling of the bucket, allowing water to drain from the bucket at the water surface, ensuring that "sweeping" to smooth contours is not done, and not overfilling the dredge scow.
4. Wait 30 minutes to 1 hour and retake measurements at the 100 foot station.
5. If no exceedances are confirmed at any 100 foot station after 30 minutes to 1 hour, continue sampling at normal 4 hour increments.
6. If exceedances continue, restart sampling as identified in Item 1.
7. If no exceedances are measured at any of the three 100 foot stations, continue sampling at normal 4 hour increments at the 100 and 150 foot stations.

3.5.2 150 foot Station

If turbidity or dissolved oxygen measurements at the 150-foot compliance boundary station are measured above the criterion for good quality marine waters as listed in Section 3.1, the following sequence of responses will be initiated.

1. If an initial exceedance is measured at the 150-foot boundary, the sampler will wait 5 to 10 minutes and retake measurements at the station. Visually assess the station vicinity for potential outside influences, such as storm drains.
2. If water quality passes the turbidity/dissolved oxygen standard, the sampling crew will move to the next station.
3. If the station water quality turbidity or dissolved oxygen standard exceedance is confirmed (two measurements in 5 to 10 minutes), the Port will be alerted to notify Ecology. The Contractor will stop work and the Port will consult with Ecology.
4. The Contractor shall take appropriate corrective action (beyond those taken to modify the work activity for 100 foot exceedances) as necessary in order to meet turbidity and dissolved oxygen standards.
5. Wait 30 minutes to 1 hour and retake measurements at the 150 foot station.

6. Continue measuring at each 100 foot compliance boundary station, as identified in Section 3.5.1.
7. If no exceedances are confirmed at any 150 foot station after 30 minutes to 1 hour, continue sampling at normal 4 hour increments and following 100-foot sampling protocols, as identified in Section 3.5.1.

In the event of exceedances occurring during two consecutive measurements (4 hours apart), the Port and the monitoring team shall:

- Immediately take action to stop the activity causing the turbidity or decrease in dissolved oxygen
- Report the exceedance to Ecology's Toxic Cleanup Program Site Manager by phone at (360) 407-6261 or (360) 485-8177, or by email at Lpea461@ecy.wa.gov.
- Discontinue any additional in-water work until the problem is resolved
- If distressed or dying fish are observed, the monitoring crew will report immediately to Ecology's Southwest Regional 24-hour Spill Response Office at (360) 407-6300

3.6 Quality Assurance

The QA objective for this project is to ensure that the data collected are of known and acceptable quality so that the goals of the water quality program can be achieved. Appropriate field QC procedures will be followed. These procedures include performing routine field instrument calibration and following standard instrument operation procedures.

4 SEDIMENT SAMPLING PROGRAM

Per the AO and IAP, performance sediment sampling will be conducted on surface sediment (0-10 cm) of the newly exposed dredge surface area in the berth area. Additional sampling events will occur following placement of the clean sand cover, 3 months after cover placement, and sampling at three 6-month intervals thereafter. Surface sediment will be tested for dioxin, grain size, moisture content, total solids, and total organic carbon (TOC). Samples will be collected from the dredge area, under-pier area, and outside of the dredge prism (within 150 feet), as shown in Figure 2. Sample results will be provided to Ecology and the Corps at the conclusion of each sampling event.

4.1 Sample Collection, Processing, and Handling Procedures

This subsection addresses the sample collection, processing, and handling procedures that will be used to ensure data quality.

4.1.1 Sampling Schedule and Platform

All sampling will occur upon the completion of dredging. The Anchor on-site Project Manager will coordinate with the Contractor and the Port and will notify Ecology and the Corps of sampling dates at least 48 hours in advance.

4.1.2 Sediment Sampling

The following sections describe the sediment sampling and equipment decontamination procedures.

4.1.2.1 Sediment Grab Collection

Collection of sediment surface grab samples will be conducted from an Anchor-provided boat using a Van Veen-type sediment grab. Sufficient sediment volume to fill the required sample jars will be collected from the top 10 cm at the sample locations. If the Van Veen sampler obtains full penetration, additional samples below the top 10 cm may be collected and archived at the laboratory.

Sample collection and processing will follow PSEP sample acceptance protocols (PSEP 1997).

4.1.2.2 *Equipment Decontamination Procedures*

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment collected for analysis shall be made of glass, stainless steel, high-density polyethylene (HDPE), or polytetrafluoroethylene (PTFE), and will be cleaned prior to each day's use and between sampling or compositing events. Decontamination of all items will follow PSEP protocols.

The decontamination procedure for sample processing equipment is:

- Pre-wash rinse with tap water
- Wash with solution of warm tap water and Alconox soap (brush)
- Rinse with warm tap water
- Rinse thoroughly with distilled water
- Cover (no contact) all decontaminated items with aluminum foil
- Store in clean, closed container for next use

4.1.3 Station and Sample Identification

Table 1 includes the surface grab sample IDs for the proposed sampling locations. Each sample was assigned a unique alphanumeric identifier using the format described below:

- Site - Sample number and Matrix code - Depth - YYMMDD
  (e.g., PO-BA-24-SS-Z-090525)

4.1.4 Station Locations

Figure 2 shows the locations of the proposed sediment surface grab sampling locations:

- Berth Area – Four samples will be collected in the berth area at the same locations as the pre-dredge samples collected in September 2008, with the exception of PO-BA-27-SE which has been moved to be within the revised dredge area (PO-BA-24-SE through PO-BA-26-SE and PO-BA-27B-SE).
- Under-pier Area – Four samples will be collected in the under-pier area at the same locations as the pre-dredge samples collected in September 2008, with the

exception of PO-UP-23-SE, which has been moved to be adjacent to the revised dredge area (PO-UP-20-SE through PO-UP-22-SE and PO-UP-23B-SE).

- Outside of Dredge Area – Three samples will be collected outside of the dredge area. Samples BI-C16 and BI-S37 are locations to the east of the dredge area that have been previously sampled. Sample PO-AM-28-SE is a new location north of the dredge area.

Three surface samples in the Berth Area (PO-BA-24-SE, PO-BA-25-SE, and PO-BA-26-SE) and two samples outside of the dredge area (BI-C16 and BI-S37) will reoccupy stations where surface sediment (0-10 cm) was previously collected using identical methodology. Previously collected under-pier characterization was conducted by sediment coring, which consisted of a 2-foot composite. In addition, sample PO-AM-28-SE has not been previously sampled.

4.1.5 Sample Containers for Analysis

AP and TA will provide certified, pre-cleaned, U.S. Environmental Protection Agency (EPA)-approved containers for all samples. Table 2 displays the sample container size and holding time for each parameter.

4.1.6 Sample Transport and Chain-of-Custody Procedures

Standard chain-of-custody procedures will control transfers of samples. Specific sample shipping procedures will be as follows:

1. Each cooler or container containing the sediment samples to be analyzed will be delivered to the laboratory within 24 hours of being sealed or kept on ice at 4 degrees Celsius until they can be delivered to the laboratory.
2. The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
3. Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
4. A sufficient amount of ice will be double-bagged in sealable plastic bags and placed within the cooler.

5. A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
6. Signed and dated chain-of-custody seals will be placed on all coolers prior to shipping.

The person(s) transferring custody of the sample containers will sign the chain-of-custody form upon transfer of sample possession to the analytical laboratory. The shipping container seal will be broken upon receipt of samples at the laboratory, and the receiver will record the condition of the samples. Chain-of-custody forms will be used internally by the laboratory to track sample handling and final disposition.

4.2 Chemical/Conventional Analyses

Surface sediments will be tested to determine post-dredge dioxin concentrations. Table 3 provides the analyte list, analytical methods, and the target laboratory detection limit for each analyte. Total toxic equivalency (total TEQ) will be calculated for dioxin data using the World Health Organization 2005 mammalian Toxicity Equivalency Factor (Van den Berg 2006), which is the same calculation used in the Sediment Characterization Study at Budd Inlet (SAIC 2008).

4.2.1 Quality Assurance/Quality Control

The frequency of analysis for laboratory QA/QC samples is summarized in Table 4, and project data quality objectives for precision, accuracy, and completeness are provided in Table 5. For dioxins/furans, initial calibrations must be completed before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet acceptance criteria. For TOC analyses, initial calibrations should be prepared daily. Ongoing calibration is required before sample analysis (and every 12 hours for dioxin/furans).

Method blanks, C-13 labeled internal standards, laboratory control samples (LCSs) (or ongoing precision and recovery [OPR] samples) are required for dioxin/furan analysis. Method blanks, LCSs (or standard reference materials [SRM]), and laboratory replicates are analyzed for conventional parameters. Laboratory replicates are analyzed for grain size.

All samples are diluted and re-analyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Any necessary cleanups will be conducted prior to the dilutions. Re-analyses are performed if internal standards or spike recoveries are outside of the data quality objective parameters. QC samples may be re-analyzed if results are not within control limits and it cannot be determined that the sample matrix is the cause.

4.2.2 Laboratory Reports

AP and TA will prepare detailed laboratory reports documenting all activities associated with the sample analyses. Included in these reports will be:

- Case Narrative – A detailed report that describes the samples received, analyses performed, and corrective actions undertaken.
- Chain-of-Custody Documentation – Laboratory policy requires that chain-of-custody documentation be available for all samples received; the chain-of-custody will document basic sample demographics such as client and project names, sample identification, analyses requested, and special instructions.
- Data Summary Form – A tabular listing of concentrations and/or detection limits for all target analytes; the data summary form will also list other pertinent information, such as amount of sample analyzed, dilution factors, sample processing dates, extraction dates, date of analyses, extract cleanups, and surrogate recoveries.
- QA Summary – Includes results of all QC analyses, specifically recovery information; LCSs are reported with each batch. Additional QC analysis may include laboratory replicates, matrix spikes, and SRMs.
- Instrument Calibration Forms and Raw Data – Includes initial and continuing calibration summaries and instrument tuning data, sample chromatograms, laboratory bench sheets, and log book pages.

Both laboratories will also provide these deliverables in EQuIS 5 electronic format.

4.3 Reporting

Final data generated during this sampling event will be submitted to Ecology and the Corps in written and electronic format. Electronic data that are representative of post-construction conditions will be submitted using Ecology's Environmental Information Management System (EIM). Data submitted to EIM will comply with Subappendix E of the SAPA (Ecology 2008b). Water quality and sediment sampling data will be summarized in the Sampling Results Report, which will include data summary tables and actual sample locations.

5 POST-DREDGE SURVEYS

Post-dredge surveys will include bathymetry and sediment profile imaging (SPI). Bathymetry will be collected in the berth areas following dredging to establish baseline conditions. Bathymetry will also be collected following placement of the clean sand cover and at the same time as surface sediment sampling events to monitor sloughing of material from the under-pier slope into the berth areas. A SPI survey will be conducted following placement of the clean sand cover to confirm the sand cover thickness. SPI procedures are included in Attachment A.

5.1 Navigation

The survey boat will be outfitted with a differential global positioning system (DGPS) for navigation. The navigation system consists of a DGPS receiver and receiving computer, and operates under hydrographic software. The DGPS will be used to determine the vessel's location in real time, and to plot the vessel's position along pre-selected survey lines. The pre-plotted survey lines and the actual survey lines traversed will be displayed in real time on a video monitor. The navigation computer will transmit event marks to the geophysical recording instruments in order to correlate the geophysical data with the survey vessel position during data analysis and mapping.

5.2 Survey Procedure, Data Processing, and Reporting

The survey procedure will consist of establishing the reference tidal datum and then acquiring bathymetric data along pre-selected survey lines. The surveyor will process the navigation and bathymetric sounding data. The output will consist of points that describe the bathymetry in terms of east-west position (X), north-south position (Y), and depth (Z) of the bottom surface. These data will be used to produce a post-dredge bathymetric surface. The bathymetric surface results will be submitted to Ecology and the Corps.

5.3 Additional Surveys

Bathymetry will also be collected following placement of the clean sand cover and at the same time as surface sediment sampling events to monitor sloughing of material from the under-pier slope into the berth areas. The survey procedure will consist of establishing the reference tidal datum and then acquiring bathymetric data along pre-selected tracklines to provide coverage and resolution comparable to the post-dredge bathymetry survey. At the

surveyor's discretion, additional tracklines may be added if necessary to "tie in" the specified tracklines.

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TABLES

Table 1
Proposed Sampling Coordinates in NAD 83, WA South

Sample ID	Northing	Easting
PO-UP-20-SE	636402	1040845
PO-UP-21-SE	636659	1040823
PO-UP-22-SE	636862	1040809
PO-UP-23B-SE	637071	1040794
PO-BA-24-SE	636383	1040776
PO-BA-25-SE	636648	1040782
PO-BA-26-SE	636853	1040769
PO-BA-27B-SE	637067	1040732
PO-AM-28-SE	637249	1040644
BI-C16	636514	1040694
BI-S37	636928	1040462

Note:
NAD North American Datum

Table 2
Guidelines for Sample Handling and Storage

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Dioxin/Furans	50 g	8-oz glass	1 year until extraction/ 1 year until analysis	Frozen/10°C
Total solids	50 g	4-oz glass	14 days	Cool/4°C
			6 months	Freeze
Total organic carbon	125 g	From TS container	14 days	Cool/4°C
			6 months	Freeze
Grain size	500 g	16-oz HDPE	6 months	Cool/4°C

Notes:
C celsius
g gram
HDPE high-density polyethylene
oz ounce

Table 3
Analyte List, Analytical Methods, and Target Detection Limits

Parameter	Units	Analytical Method	Sediment Management Standards Criteria		DMMP Screening Level	Target Laboratory Detection Limit[a]
			Sediment Quality Standards	Cleanup Screening Level		
Geotechnical Parameters						
Moisture Content	%	ASTM D-2216	---	---	---	0.1
Conventional Parameters						
Clay	%	PSEP	---	---	---	0.1
Fines	%	PSEP	---	---	---	0.1
Total solids	%	PSEP	---	---	---	0.1
Total organic carbon	%	PSEP	---	---	---	0.1
Dioxin/Furans						
Dioxins						
2,3,7,8-TCDD	ng/kg dry wt	EPA 1613	---	---	---	1
1,2,3,7,8-PeCDD	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,4,7,8-HxCDD	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,6,7,8-HxCDD	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,7,8,9-HxCDD	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,4,6,7,8-HpCDD	ng/kg dry wt	EPA 1613	---	---	---	5
OCDD	ng/kg dry wt	EPA 1613	---	---	---	10
Furans						
2,3,7,8-TCDF	ng/kg dry wt	EPA 1613	---	---	---	1
1,2,3,7,8-PeCDF	ng/kg dry wt	EPA 1613	---	---	---	5
2,3,4,7,8,-PeCDF	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,4,7,8-HxCDF	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,6,7,8-HxCDF	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,7,8,9-HxCDF	ng/kg dry wt	EPA 1613	---	---	---	5
2,3,4,6,7,8-HxCDF	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,4,6,7,8-HpCDF	ng/kg dry wt	EPA 1613	---	---	---	5
1,2,3,4,7,8,9-HpCDF	ng/kg dry wt	EPA 1613	---	---	---	5
OCDF	ng/kg dry wt	EPA 1613	---	---	---	10

Table 4
Laboratory QA/QC Frequency

Analysis Type	Initial Calibration	Ongoing Calibration	Standard Reference Material/LCS[c]	Replicates	Matrix Spikes[d]	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Grain size	Each batch[a]	NA	NA	1 per 20 samples	NA	NA	NA	NA
Total solids	Each batch[a]	NA	NA	1 per 20 samples	NA	NA	NA	NA
Total organic carbon	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	NA	NA	1 per 20 samples	NA
Dioxin/furans	As needed[b]	Every 12 hours	1 per 20 samples	NA	NA	NA	1 per 20 samples	Every sample[d]

Notes:

a Calibration and certification of drying ovens and weighing scales are conducted bi-annually.

b Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.

c Ongoing precision and recovery (OPR) samples will be analyzed before any samples for dioxin/furan analysis; standard reference materials from round robin studies may be used.

d Isotope dilution internal standards are spiked in every dioxin/ furan sample to assess method performance in the sample matrix.

NA Not applicable.

LCS Laboratory control sample.

Table 5
Project Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Grain size	+/- 20% RPD	NA	95%
Total solids	+/- 20% RPD	NA	95%
Total organic carbon	+/- 20% RPD	75-125% R	95%
Dioxin/Furans	+/-35% RPD	50-150% R	95%

Notes:

NA not applicable

RPD Relative percent difference

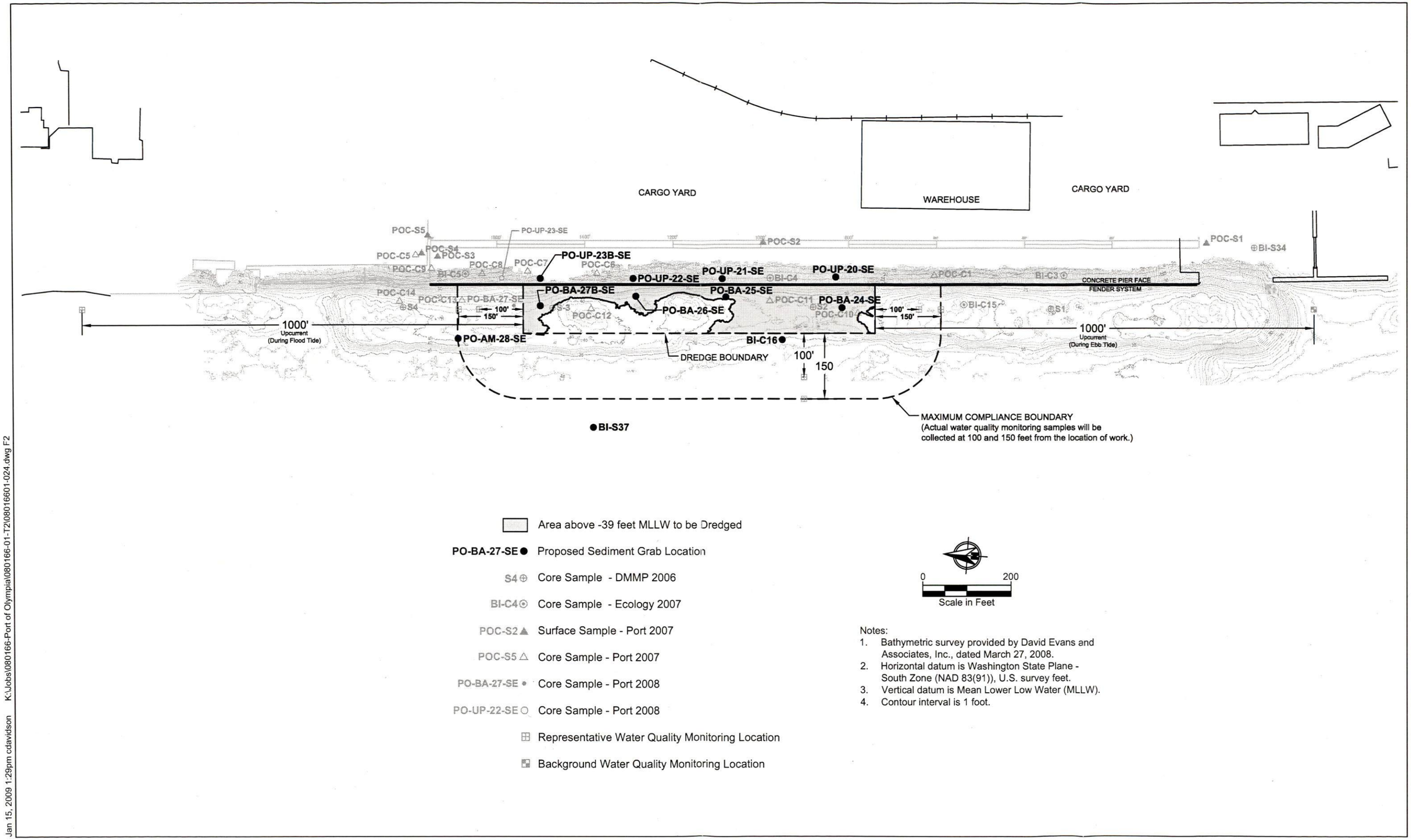
R Recovery

FIGURES

Oct 29, 2008 3:06pm heriksen K:\Jobs\080166-Port of Olympia\080166-01-T2\080166601-019.dwg F1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Vicinity Map
Water Quality Monitoring and Sediment Sampling Plan
Port of Olympia



Area above -39 feet MLLW to be Dredged

PO-BA-27-SE ● Proposed Sediment Grab Location

S4 ⊕ Core Sample - DMMP 2006

BI-C4 ⊙ Core Sample - Ecology 2007

POC-S2 ▲ Surface Sample - Port 2007

POC-S5 △ Core Sample - Port 2007

PO-BA-27-SE • Core Sample - Port 2008

PO-UP-22-SE ○ Core Sample - Port 2008

⊞ Representative Water Quality Monitoring Location

▩ Background Water Quality Monitoring Location

0 200

Scale in Feet

Notes:
1. Bathymetric survey provided by David Evans and Associates, Inc., dated March 27, 2008.
2. Horizontal datum is Washington State Plane - South Zone (NAD 83(91)), U.S. survey feet.
3. Vertical datum is Mean Lower Low Water (MLLW).
4. Contour interval is 1 foot.

Jan 15, 2009 1:29pm cdavidson K:\Jobs\080166-Port of Olympia\080166-01-T2\080166601-024.dwg F2

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 2
Approximate Water Quality Monitoring and Sediment Sampling Locations
Water Quality Monitoring and Sediment Sampling Plan
Port of Olympia

ATTACHMENT A

SEDIMENT PROFILE IMAGING PROCEDURES

PORT OF OLYMPIA
WEST BAY BERTHS 2 AND 3

Prepared for

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and

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January 2009

Table of Contents

List of Figures

1 INTRODUCTION

This Attachment details the approach and methods to be used for data collection and data analysis of a sediment profile imaging (SPI) survey of the Port of Olympia (Port) Berths 2 and 3 Interim Action cleanup area. The objective of this work is to provide additional information regarding the thickness of clean cover material placed in the dredged area within Berths 2 and 3. This information, in conjunction with bathymetry surveys conducted following dredging and following placement of the clean cover, will provide supporting information that adequate cover material has been placed in the dredge footprint (minimum placement of 6 inches). Sampling will consist of collecting SPI images at stations spaced equally over the area covered with clean material. Section 2 describes sample collection techniques, and Section 3 describes SPI image analysis methodology and reporting.

2 SPI SAMPLE ACQUISITION

2.1 Field Personnel

The field team that will collect the SPI data will be comprised of the following companies and their representatives:

Anchor Environmental, L.L.C. (Anchor)

- Mr. David Templeton, Principal, will be responsible for the overall management of project activities.
- Mr. Dan Berlin, Senior Environmental Scientist, will be responsible for the management of all field operations to ensure that the collection of data meets project objectives.

Germano and Associates, Inc.

- Dr. Joseph Germano, President, will lead the collection of SPI images and ensure that the collection of images meets project objectives.
- Mr. David Browning, Senior Scientist, will assist Dr. Germano in the collection of SPI images and be primarily responsible for on-deck operations.

2.2 Sampling Platform

The sampling vessel will be suitable for the collection of SPI images. It will safely deploy and retrieve the SPI camera. The SPI camera assembly weights 1,200 pounds fully weighted. Minimally, these vessels have:

- An enclosed wheel house
- A winch capable of lifting the camera
- An A-frame, boom, or davit (small crane attached to the boat) to deploy the camera off the vessel deck
- Steel winch cable 1/4-inch or greater
- Adequate deck space for the SPI camera and operators

2.3 Positioning, Station Locations, and Nomenclature

Navigation and positioning will be accomplished using a differential global positioning system (DGPS) interfaced to an integrated navigation system. Navigation and positioning

services will be provided by the research vessel. The DGPS system used by the vessel will be capable of providing positional accuracy of +/- 2 meters.

Because one of the primary goals of the survey is to ensure adequate aerial coverage of the clean cover area, it will be more important to document the location of sampling rather than navigating to a specific point for replicate sampling. Therefore, the locations of SPI sample acquisition will be recorded both digitally within the integrated navigation software package and in the field log. Actual locations will be refined in the field depending on field conditions in order to best characterize site conditions.

To best characterize the area while working in the field, a north-south grid will be superimposed over these areas. The grid will be alphanumerically labeled, with north-south columns receiving an alphabetic label (beginning at "A" from west to east) and rows receiving a numeric label with numbers increasing from north to south. For example, the northwestern-most grid cell would be labeled A-1, moving eastward in the upper row of grid cells, station names would be B-1, C-1, etc. This will allow the stations sampled in the field to be geographically referenced to the sample area by station name alone. Assuming 20 to 30 sample locations, grid cells are expected to be spaced less than 50 feet apart. The target sampling grid will be provided to Ecology prior to field data collection.

2.4 SPI Image Collection

2.4.1 SPI Camera Description

The SPI camera operates similar to an inverted periscope. A digital camera is mounted horizontally inside a water-tight housing located on top of a wedge-shaped prism. The prism has a Plexiglas® faceplate at the front with a mirror placed at a 45-degree angle at the back. The camera lens looks down at the mirror, which reflects the image from the faceplate. The prism has an internal strobe mounted inside at the back of the wedge to provide illumination for the image; this chamber is filled with distilled water, so the camera always has an optically clear path to shoot through. This wedge assembly is mounted on a moveable carriage within a stainless steel frame. The frame is lowered to the seafloor on a winch wire, and the tension on the wire keeps the prism in its "up" position. When the frame comes to rest on the seafloor, the winch wire goes slack (Figure A1) and the camera prism descends into the sediment at a slow, controlled rate

by the dampening action of a hydraulic piston so as not to disturb the sediment-water interface. On the way down, it trips a trigger that activates a time-delay circuit of variable length (operator-selected) to allow the camera to penetrate the seafloor before any image is taken. The knife-sharp edge of the prism transects the sediment, and the prism penetrates the bottom. The strobe is discharged after an appropriate time delay to obtain a cross-sectional image of the upper 20 cm of the sediment column. After the first image is obtained at the first location, the camera is then raised approximately 2 to 3 meters off the bottom to allow the strobe to recharge. The strobe recharges within 5 seconds, and the camera is ready to be lowered again for another replicate image, if required. The resulting images give the viewer a similar perspective as though looking through the side of an aquarium half-filled with sediment. Camera settings (f-stop, shutter speed, ISO equivalents, digital file format, color balance, etc.) are selectable through a water-tight USB port on the camera housing and camera software.

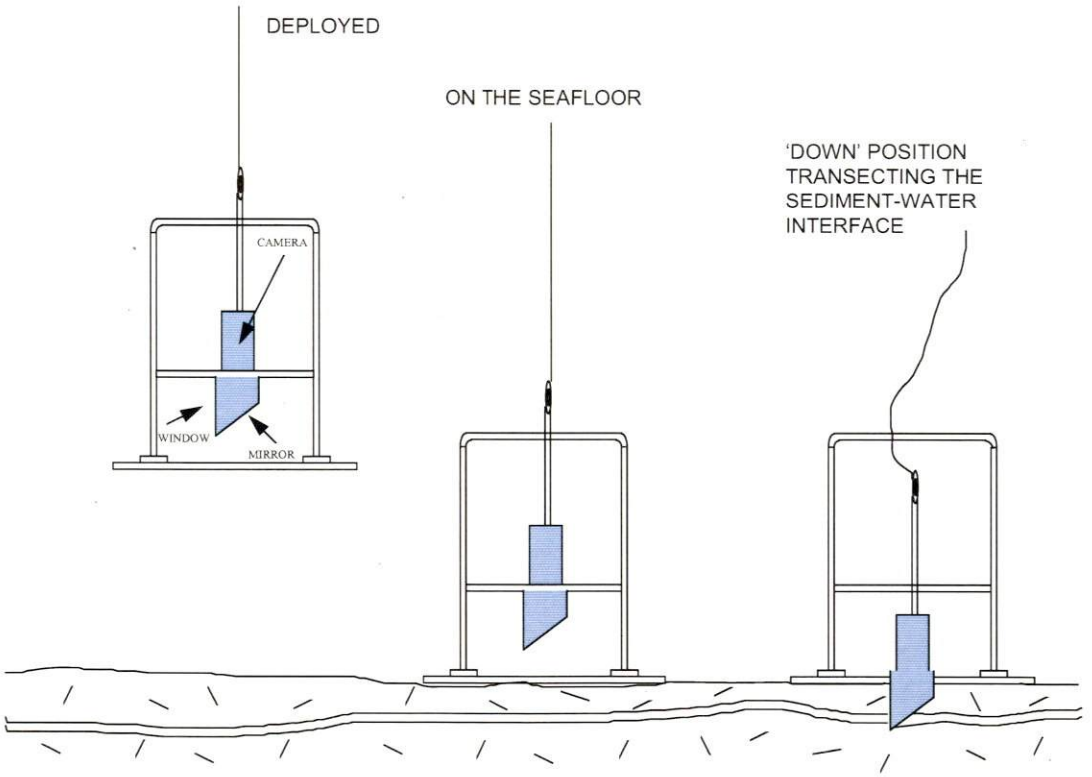

Figure A1 SPI Camera Operation Sequence

2.4.2 SPI Operation and Data Collection

At the beginning of the survey, the time on the sediment profile camera's internal data logger will be synchronized with the internal clock on the computerized navigation system. To maximize aerial coverage, one image will be taken at each station and three replicate images will be taken at a subset of the station (not to exceed 20 percent of the total station); each SPI replicate will be identified by the time recorded on the digital file and on disc, along with vessel position. In the case of multiple replicate images at a single sampling station, each image will be assigned a unique time stamp in the digital-file attributes by the data logger and cross-checked with the time stamp in the navigational system's computer data file. The field crew will keep redundant written sample logs. Images will be downloaded periodically throughout the day to verify successful sample acquisition or to assess the type of sediment present at a particular station. Digital image files will be re-named with the appropriate station name immediately after downloading on deck as a further quality assurance step.

2.5 Field Sampling Quality Assurance/Quality Control and Data Storage

Test exposures of the Kodak® Color Separation Guide (Publication No. Q-13) will be fired on deck at the beginning and end of each survey to verify that all internal electronic systems are working to design specifications, and to provide a color standard against which final images can be checked for proper color balance. A spare camera and charged battery will be carried in the field at all times to insure uninterrupted sample acquisition. After deployment of the camera at each station, the frame counter will be checked to make sure that the requisite number of replicates was taken. In addition, a prism-penetration depth indicator on the camera frame will be checked to verify that the optical prism actually penetrated the bottom to a sufficient depth to acquire a profile image. If images were missed (frame counter indicator or verification from digital download) or the penetration depth was insufficient (penetration indicator), chassis stops will be adjusted and/or weights will be added or removed, and additional replicate images will be taken. Changes in prism weight amounts, the presence or absence of mud doors, and chassis stop positions will be noted in the log for each replicate image.

3 SPI IMAGE ANALYSIS

Following completion of field operations, the digital images will be analyzed from this survey using Sigma Scan® software (Aspire Software International). Calibration information will be determined by measuring 1-cm gradations from the Kodak® Color Separation Guide. This calibration information will be applied to all analyzed SPI images. Linear and area measurements will be recorded as number of pixels and converted to scientific units using the calibration information.

Measured parameters will be recorded on a Microsoft Excel® spreadsheet. Germano and Associates' Senior Scientist, David Browning, will conduct the image analysis and all analyses will be subsequently checked by Dr. Joseph Germano. This step will provide an independent quality assurance/quality control review of the measurements before final interpretation is performed.

The distribution of these measured parameters across the survey area will allow cover thickness characteristics to be identified. SPI is effective in measuring layers ranging in thickness from 20 cm (the height of the SPI optical window) to 1 mm. During image analysis, the thickness of the sand cover can be determined by measuring the linear distance between the pre- and post-cover placement sediment-water interface. Recently deposited material, including clean cover, is usually evident because of its unique optical reflectance and/or color, relative to the underlying material representing the pre-cover placement surface. Also, in most cases, the point of contact between the two layers is clearly visible as a textural change in sediment composition, facilitating measurement of the thickness of the recently deposited layer.

Parameters to be measured from the SPI images will consist of:

- Prism-penetration depth
- Clean cover thickness
- Interpretive comment field detailing qualitative assessment of mixing between underlying sediment and clean cover discernible from the image

3.1 Data Evaluation and Reporting

After the image analysis results have been reviewed for accuracy, the distribution of the measured parameters will be plotted across the area sampled. In addition, all image

analysis results will be presented in table form. Images collected from the survey will be submitted in .jpg file format on compact disc (CD) or digital video disc (DVD).

An analysis letter report detailing the cover thickness in the area will be prepared and submitted to the Port within 5 days following the conclusion of field activities. The Port will provide this letter report to Ecology. This letter report will include the following elements:

- Summary of field activities
- Project map illustrating approximate locations of sample stations
- Summary of findings detailing the cover thickness at each location

Depending on the results, the Port may require the contractor to place additional cover material in specific locations if it is clear that a minimum of 6 inches of cover was not placed. The Port will coordinate with Ecology if additional placement is necessary.