Sampling and Analysis Plan

Preliminary Sediment Assessment for PSDDA Parameters Weyerhaeuser East Site Everett, Washington

Prepared for

Weyerhaeuser Paper Company

Everett, Washington

PTI

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Weyerhaeuser Paper Company
101 E Marine View Drive
Everett, Washington 98201

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ACRONYMS AND ABBREVIATIONS

BT	bioaccumulation trigger
DGPS	differential global positioning system
EPA	U.S. Environmental Protection Agency
ML	maximum level
MLLW	mean lower low water
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
Port	Port of Everett
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PTI	PTI Environmental Services
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SL	screening level
SOP	standard operating procedure
VOC	volatile organic compound
Weyerhaeuser	Weyerhaeuser Paper Company

1. INTRODUCTION

This sampling and analysis plan (SAP) describes work to be conducted for the Weyerhaeuser Paper Company (Weyerhaeuser) by its technical consultant, PTI Environmental Services (PTI), as part of a preliminary assessment of sediment conditions in the Snohomish River off the Weyerhaeuser East Site in Everett, Washington (Figure 1). Weyerhaeuser and the Port of Everett (Port) are interested in assessing the likely suitability of sediments off the East Site for dredging and possible disposal at a Puget Sound Dredged Disposal Analysis (PSDDA) site in Puget Sound, in the event that the property is conveyed to the Port for industrial redevelopment. However, it is understood that because actual plans for any such future dredging project have not been defined, this sediment sampling plan will not be submitted to the PSDDA agencies for review and approval. Furthermore, it is understood that the results of this investigation are not likely to be directly applicable to a specific dredging project in the future.

The goal of this investigation is to sample the uppermost 4 ft of sediments from 10 locations and to chemically analyze those sediments for the various physical and chemical parameters that would be required for evaluation of the sediments under the PSDDA program. The chemical concentrations in the sediments will be compared with PSDDA screening levels (SLs), maximum levels (MLs), and bioaccumulation trigger (BT) values to provide a preliminary assessment of the likely suitability of the sediments for disposal at a PSDDA unconfined, open-water site. Biological testing of the sediments through the use of sediment toxicity tests is not included in the present scope.

It is intended that the sediments will be composited over the depth of each 4-ft core because that depth is the maximum core length allowed to be composited for PSDDA purposes. In the event that any future dredging will have to extend to greater depths beneath the sediment surface, these cores will not provide an indication of conditions at greater depth. However, depending on the history of dredging, if any, in the project area, it is possible that sediments at depths greater than 4 ft may represent native material that is unlikely to have received sediment contamination. If, in such a case, the uppermost sediments are likely suitable for PSDDA disposal, it would be expected that any deeper sediments would also be suitable for such disposal.

A brief summary of existing data from earlier studies at the Weyerhaeuser East Site is provided in this SAP. Details of the field sampling procedures and analyses to be performed are described in the sections titled Sediment Collection and Chemical Analyses. Sample collection and analysis procedures used in this study follow current guidelines of the U.S. Environmental Protection Agency (EPA) Region 10, Puget Sound Estuary Program (PSEP). The usefulness of the data for comparison with PSDDA SLs and MLs and with results of other studies will depend on the implementation of rigorous, standardized quality assurance and quality control measures. The quality assurance project plan (QAPP) for the testing laboratory is provided in Appendix A. Standard operating procedures (SOPs) are provided in Appendix B. Example field data forms are provided in Appendix C. A health and safety checklist is included as Appendix D.

1.1 BACKGROUND AND SITE HISTORY

Historically, Weyerhaeuser has owned and operated various wood products facilities in north Everett, including several pulp mills, sawmills, and log sort facilities. Currently, Weyerhaeuser owns approximately 300 acres of industrial land in north Everett. From 1915 until 1979, Weyerhaeuser operated a sawmill (Mill B) at the East Site (Figure 1). From about 1950 to 1970, it is known that dredging of river sediments to a depth of -10 ft below mean lower low water (MLLW) was conducted annually off the Mill B log ramp and south along the bulkhead to the northern end of Ferry Baker Island. It can be assumed that similar dredging was conducted periodically from the time Mill B first operated (1915) until 1950. Prior to 1970, the dredged sediments were disposed of in Port

Gardner Bay. Annual dredging of the area off Mill B continued until the mill closed in 1979, with disposal of the dredged sediments from 1971 to 1979 on Ferry Baker Island. The dredged material consisted of approximately 90 percent sand and silt deposited by the river and 10 percent wood debris, both from the mill and from the river. Since the last dredging in 1979, there has been continued deposition of sediments off Mill B from the river. In 1982, a fire destroyed a substantial portion of the abandoned sawmill buildings. All structures associated with the sawmill that were not destroyed in the fire were subsequently demolished.

In 1946, Weyerhaeuser leased land southeast of the sawmill to American Lumber and Treating Company, and in 1947–1948, a wood treatment facility was constructed on the site (Figure 1). Operation of that facility was transferred to the Koppers Company in the early 1950s, and wood treatment was conducted there until 1963. The wood treatment buildings were later used by Weyerhaeuser for equipment maintenance. In 1973, Weyerhaeuser began using the site of the former wood treatment facility as a sawmill (Mill E), which continued operation until 1984. In 1981, approximately 17,600 cubic yards of silty sand were dredged from an area of about 125 ft by 225 ft offshore of Mill E to facilitate installation of a new log ramp (Figure 1). The average dredged depth was -10 ft MLLW; a portion of the dredged area about 30 ft by 40 ft was dredged to -16 ft MLLW. The dredged sediments were disposed of on Ferry Baker Island. No dredging is believed to have been conducted in the area after Mill E closed in 1984, and it is assumed that considerable shoaling has occurred since that time. In 1995, the buildings at Mill E were demolished. The site of the former wood treatment facility and Mill E was the subject of a remedial investigation conducted by EMCON for Weyerhaeuser.

Currently, virtually all of the Weyerhaeuser East Site is vacant, although the foundations of some of the buildings remain. A bulkhead borders the river along most of the site. Four stormwater outfalls (SW3, SW4, SW5, and SW6; Figure 1) provide drainage from the site and discharge to the Snohomish River through the bulkhead.

1.2 PREVIOUS STUDIES

The only known studies of sediments in the general vicinity of the Weyerhaeuser East Site were conducted as part of the remedial investigation of the wood treatment facility by EMCON (1996). Shallow (0-2 ft) sediment cores were collected in 1992 from a number of stations in intertidal and shallow subtidal areas just offshore of the former wood treatment facility and Mill E. Three chemicals (arsenic, naphthalene, and acenaphthene) were found in elevated concentrations at several stations. In 1995, additional surface sediment samples were collected in those areas that had previously exhibited elevated chemical concentrations. In three of those samples, only arsenic was found in elevated concentrations.

2. SEDIMENT COLLECTION

Detailed procedures for sediment sample collection, handling, and shipping are described in this section, including procedures for:

- Documenting the locations of stations
- Establishing sample identifiers
- Decontaminating equipment, work surfaces, and sampling implements prior to commencing sampling and between stations
- Collecting sediment samples
- Compositing and processing of sediment samples
- Completing standard forms to document the collection effort.

2.1 STATION LOCATIONS

Sediment cores will be collected from 10 stations distributed along the shoreline of the site (Figure 2). Four of these stations (Stations WE-01, WE-03, WE-04, and WE-08) are positioned just downstream of the four stormwater outfalls to assess whether discharges from those outfalls may have contaminated the sediments. One station (Station WE-02) is positioned offshore of an area at the former wood treatment facility where groundwater is known to be contaminated. One station (Station WE-06) is positioned offshore of the former clarifier, and one station (Station WE-07) is positioned offshore of the former log ramp at the sawmill. The remaining three stations (Stations WE-05, WE-09, and WE-10) are not positioned with respect to onshore site features, but are instead distributed throughout the offshore portion of the Weyerhaeuser East Site.

2.2 VESSEL OPERATION AND NAVIGATION

The field sampling team will consist of two ENSR staff to operate the sampling vessel and vibrocorer, a PTI chief scientist, and one PTI crew member. The chief scientist will be responsible for all decisions concerning sample collection. If a significant deviation from this SAP is being considered because of conditions encountered during sampling, the chief scientist will notify the PTI project manager or the Weyerhaeuser project manager. The sampling crew will be provided with a portable cellular telephone to allow rapid and direct consultation.

Sediment sampling operations require the ability to accurately determine and record the station positions. Positioning and navigation of the sampling vessel will be accomplished through the use of a differential global positioning system (DGPS) that is integrated with a navigation computer and custom software. The navigation data acquisition system on the sampling vessel consists of a personal computer equipped with a custom navigation and hydrographic software package. When used in concert with the DGPS survey equipment, the system provides real-time vessel positioning with position accuracies to less than 2 m. The DGPS consists of two satellite receivers linked to each other by a VHF telemetry radio system. One receiver is located on the survey vessel and the other is set up over a known reference point on land. Ranges are continuously calculated for up to eight satellites and real-time vessel positions are determined trigonometrically by the on-board computer system. The base station differential corrections will be received from the United States Coast Guard differential correction station located on Whidbey Island. Position coordinates during all sediment sampling operations will be recorded in the WGS-84, Universal Transverse Mercator grid system in meters, with a zone central meridian set at 123°W longitude.

Water depth at each sampling station will be measured at the time of core collection with a lead line. All sampling locations will be documented with photographs.

2.3 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 (i.e., replicates) to ensure proper data analysis and interpretation, 2) to obscure the relationships between samples so that laboratory analysis will be unbiased by presumptive similarities between samples, and 3) to track individual sample containers to ensure that the laboratory receives all of the material associated with a single sample. To accomplish these purposes, each container has two different codes associated with it: the sample number and the sample tag. These codes and their uses are described below:

- **Sample Number**—The sample number is an arbitrary number assigned to each sediment sample collected. Each field replicate of a given type will have a different sample number, and the sample numbers of related field replicates will not necessarily have any shared content. To prevent laboratory personnel from associating related samples, the sample number appears on the sample containers, the chain-of-custody forms, and the sample analysis request forms.
- **Sample Tag**—A different sample tag is attached to each sample container. If a collection of material (i.e., everything associated with a single sample number) is too large for a single container, each container will have the same sample number and a different sample tag. A sample will also be split between containers if a different preservation technique is used for each container (i.e., because different analyses will be conducted). The sample tag number will appear on the chain-of-

> custody forms and sample analysis request forms. Tag numbers allow laboratories to confirm that they have received all of the containers that were filled and shipped. Tag numbers are not used thereafter and data are reported by sample number.

Sample numbers will be assigned sequentially in the field; sample tags will be preprinted with tag numbers.

2.4 SEDIMENT SAMPLING PROCEDURES

Decontamination procedures, field sampling procedures, and sample compositing and processing methods are described in the following sections.

2.4.1 Decontamination Procedures

Sediment cores will be collected using a vibrocore sampler, which consists of a core tube, a cutting tip, a disposable Lexan® core liner, and a hydraulic drill head that generates vibrations in the drill string. The only field equipment that will come in contact with the sediment cores is the cutting tip and the core liners. Because the core liners are only used once, the only required decontamination is a rinse of the inner surface of a new core liner with hexane, followed by a rinse with distilled water. The cutting tip of the vibrocore will be decontaminated prior to its first use and again between sampling stations. Decontamination of the cutting tip will consist of scrubbing with Alconox®, rinsing with site river water, solvent-rinsing with acetone and then hexane, air-drying, and finally rinsing with site river water. The acetone and hexane rinsates will be collected in a container, and the small volume collected will be allowed to evaporate.

Extraction of the sediments from the core liners, compositing, and filling of sample bottles with sediments for shipment or delivery by courier to the analytical laboratory will be conducted in PTI's field office. All equipment (e.g., stainless-steel spoons and bowls) used in the processing of the samples will be decontaminated before processing each sample using the same procedures as for the field decontamination of the cutting tip, except that deionized water will be used instead of river water.

2.4.2 Sediment Coring

At a location selected by the chief scientist at each station, the vibrocore will be lowered to the bottom and turned on. The vibration of the vibrocore, aided by the weight of the equipment itself, liquefies the sediment particles in direct contact with the core tube walls. The core then slowly cuts its way into the substrate and produces relatively undisturbed core samples. The sediments are retained within the core liner. Once on deck, the core liner with the retained sediments will be removed from the core tube, and the chief scientist will confirm that a minimum of 4 ft of sediments was recovered. The section of the core liner containing the targeted depth of sediments will then be cut off, and the ends of the core liner containing the sediments will be capped and sealed with tape.. Each core liner (i.e., one from each sampling station) will be uniquely labeled, recorded in the field notebook, and placed on ice in a cooler for transport to PTI's field office for extraction and compositing of the sediment samples.

Prior to sampling at the next station, a new, decontaminated core liner will be inserted in the core tube, and the cutting head of the core tube will be decontaminated and reattached to the core tube.

2.4.3 Sediment Sample Compositing and Processing

All sample containers will be provided by the laboratory and prepared in accordance with PSEP guidelines (PSEP 1986a) prior to field operations. Sample containers will be kept closed and in a cooler until use. The sediments within each core liner will be extracted and aliquots will immediately be removed and placed in appropriate containers for the analysis of potentially volatile components (e.g., total sulfides, volatile organic compounds [VOCs]). The remaining sediments from each core will be composited in a stainless-steel bowl using a large stainless-steel spoon to achieve a uniform texture and color before aliquots are taken and transferred to the appropriate containers for shipment or delivery by courier to the analytical laboratory.

As they are collected, sediment samples will be fully labeled, recorded in the field notebook and on chain-of-custody forms, and returned to coolers as soon as possible. Immediately after they are filled, all sample containers will be placed on ice in a cooler at 4°C.

Sediment samples for all chemical analyses will be shipped or delivered by courier on ice (4°C) to the analytical laboratory and will be stored at 4°C until analysis and final disposition of the samples. All field samples will be analyzed as soon as possible after receipt at the laboratory. Maximum sample holding times are stipulated in the QAPP (see Appendix A).

Chain-of-custody and sample analysis request forms will be completed and signed by the PTI chief scientist and shipped or delivered by courier with the samples to the Weyerhaeuser Analytical Laboratory in Federal Way, Washington.

Samples shipped or delivered by courier will be packed in bubble-wrap plastic to prevent breakage, and chain-of-custody seals will be placed across the cooler lids. Chain-of-custody forms will be enclosed in the coolers with the samples and will be signed at the laboratory upon receipt. A copy of the signed form will be returned to PTI. SOPs for sample packaging and shipping are described in Sample Packaging and Shipping (Appendix B).

2.5 DOCUMENTATION

The integrity of each sample from the time of collection to the point of data reporting must be maintained throughout the study. Proper recordkeeping and chain-of-custody procedures will be implemented to allow samples to be traced from collection to final disposition. Various logs and forms are required to adequately identify and catalog station and sample information, including the following:

- **Station/Sample Log**—Each gear deployment event will be recorded on a station log sheet. One or more station/sample log sheets will be completed for each station sampled. The station name, date, gear, and cast number; depth; and location coordinates will be recorded on each log sheet. Penetration depth, sediment type, sediment color, and sediment odor will also be recorded for sediment samples. The sample type, sample identifier, sample number, and sample tag number will also be recorded on the station/sample log sheet.

- **Chain-of-Custody Form**—Each sample container will be recorded on a chain-of-custody form. Both the sample tag and the sample number will be shown. The chain-of-custody form will also identify the sample collection date and time, the type of sample, the project, and the chief scientist. The chain-of-custody form will be sent to each laboratory analyzing a fraction of a sample. Chain-of-custody forms will be completed in triplicate with one copy retained by the chief scientist.

- **Sample Analysis Request Form**—Each set of samples sent to a laboratory will be accompanied by a sample analysis request form. The sample analysis request form will identify samples by sample number and sample tag. For each sample tag, the sample analysis request form will identify the preservative or other sample pretreatment applied and the analyses to be conducted by referencing a list of specific analytes or the statement of work for the laboratory. One copy of this form will be retained by the chief scientist, and the original form will accompany the shipment.

- **Sample Label and Chain-of-Custody Seal**—A sample label will be completed for each sample. Sample containers will be labeled prior to the time of sampling with the following information: sample number, site name, sampling date and time, sampling personnel, preservative (if appropriate), and tag number. A chain-of-custody seal will be placed across the lid of the cooler prior to shipping.

At the time of sampling, the sample number and analysis code for each sediment aliquot will be recorded in the field logbook. After each bottle is filled, the chief scientist will initial the label to document proper sample handling. At the end of each day, and prior to shipping or storage, chain-of-custody entries will be made for all samples. Finally, information on the labels will be checked against field logbook entries and samples will be recounted.

The PTI chief scientist is responsible for properly completing all forms. Station and sample logs must be completed at the time the observations are made. Chain-of-custody forms and sample analysis request forms will be completed and signed before the end of each sampling day and before the samples are removed from the vessel or pass from the control of the PTI chief scientist. Chain-of-custody forms will be signed at each additional point of transfer of samples between the field and the laboratory and within the laboratory. Copies of all forms will be retained by PTI and included as appendices in the resulting data report.

Appendix C contains examples of the various logs and forms that are used to record information at each sampling location. A bound field notebook will also be completed for this sampling event. Any changes in the sampling procedures described in this SAP will be documented in the field notebook.

2.6 SAMPLING SCHEDULE

Sampling is anticipated to begin on July 8, 1996, and is estimated to require 1–2 working days on site. The sequence of sample collection will be arranged to maximize collection efficiency and to coincide with the tides and currents in the study area. The actual sequence in which the stations will be visited will be determined in the field based on field conditions.

2.7 SAMPLING SAFETY

Safety hazards are associated with the equipment and supplies that will be used, as well as with the general rigors of work on the water. A health and safety checklist is provided in Appendix D; its purpose is to identify potential hazards, institute procedures for minimizing those hazards, prepare the proper responses in case of accident and injury, and make this information known to all shipboard personnel. At the start of the first day of sampling, a health and safety briefing will be held with the Weyerhaeuser project manager and all field personnel in attendance.

To ensure safe and efficient shipboard operations, the PTI chief scientist will be designated safety officer responsible for all shipboard operations, including evaluating hazardous conditions, ensuring compliance with safety precautions, and suspending shipboard operations if necessary. A halt to or suspension of operations can also be dictated by the vessel operator.

2.7.1 Hazards

Hazards encountered during sampling are generally classified as either chemical or physical. Chemical hazards are primarily associated with the materials used to clean sampling gear. Physical hazards are associated with the gear and conditions of work on the water.

2.7.1.1 Chemical Hazards

Based on existing data, stations to be sampled during the survey are not expected to contain concentrations of chemicals (including natural sulfides) that pose a hazard to human health. During field operations, if excessive odor, nonaqueous liquids, or organic enrichment is observed, the sampling plan will be reassessed. Precautionary steps may include artificially ventilating the deck, instituting suitable protective measures for the crew, or relocating or eliminating the sampling station.

Acetone and hexane will be used to clean the sampling equipment. Both are clear, colorless, volatile solvents with strong odors. At the present time, neither chemical is a suspected carcinogen. Acetone and hexane will be used only on the open deck and personnel must wear protective gloves when handling these liquids.

Material safety data sheets for acetone and hexane are included in Appendix D.

2.7.1.2 Physical Hazards

Gear deployment and retrieval present hazards because of the weight of the sampling gear, its suspension above the deck, and the risk of entanglement or accidental or premature release or closure. While gear deployment hazards are expected to be minimal, physical hazards associated with the vibrocorer do exist.

Lines, hoses, and mud on the deck present tripping, slipping, and falling hazards. Every crew member will be instructed to keep the working surface of the deck clear and clean by coiling hoses and lines and rinsing accumulations of mud from the deck. In addition, all crew members will remain aware of the positions of other gear at all times.

A drowning hazard exists for shipboard personnel working on the water primarily from tripping (discussed above) or excessively rough weather. Flotation vests will be worn by all personnel on deck.

Fatigue presents a hazard when working on the water and can be compounded by the motion of the vessel, exposure, or hypothermia. Personnel will monitor their own condition and capabilities and are responsible for taking appropriate measures to relieve fatigue, exposure, or hypothermia. The PTI chief scientist may also direct any member of the crew to cease working.

2.7.2 Safe Work Practices

Precautions for handling chemicals include wearing gloves, restricting use to the deck, storing and dispensing them from narrow-mouth bottles or squirt bottles, and exercising care in use. Solvent rinsate from sampling gear will be collected in a container so excess solvent is not spilled on the deck. The sea condition and presence of wakes or other disturbances will be noted to avoid spillage.

All crew members will wear hardhats when working on the deck. Work gloves will be available but not required (impermeable gloves are required when using acetone or hexane). Flotation vests will be worn by all personnel on deck.

During gear deployment and retrieval, personnel should pay close attention to the position of the gear, the motion of the boat, obstructions on the deck that could impede their mobility, and actual or potential fouling of the gear. Hands and feet must never be placed underneath sampling gear.

Weather conditions will be monitored by the PTI chief scientist and vessel operator. Each crew member will be required to bring clothing appropriate for the weather to minimize the hazards of exposure and hypothermia.

2.7.3 Emergency Planning

If an emergency or accident occurs during sampling, the PTI chief scientist and vessel operator will determine the appropriate response. This includes assessing the severity of the incident and, if appropriate, contacting emergency assistance. The vessel operator is responsible for moving the boat into position to receive emergency aid, if necessary. A basic first-aid kit will be kept on board to treat minor cuts or scrapes. All PTI field personnel have received first aid and CPR training. All accidents must be reported to the PTI chief scientist and will be recorded in the cruise log. Contact information for local emergency services, hospitals, and ambulance services will be onboard the boat in a location known and accessible to all personnel. Emergency contact information is provided in Appendix D.

3. CHEMICAL ANALYSES

Analytical procedures will be in accordance with requirements specified in the selected methods. All analyses for organic and inorganic compounds, except for conventional parameters, will be performed in accordance with procedures established by EPA SW-846 Methods (U.S. EPA 1986 and updates I and II), as modified by PSEP (1989a,b). Conventional analyses (i.e., ammonia, total sulfides, total organic carbon, total volatile solids, total solids, and grain-size distribution) will be performed in accordance with standard methods specified by PSEP (1986b) or U.S. EPA (1983).

3.1 CHEMICAL ANALYSES

Analytical procedures for each compound class are summarized below. For sediment samples, the laboratory shall assume that the entire sample submitted for analysis is representative material. To avoid substance losses, any overlying water in sediment samples received from the field will be mixed into the sample before removal of a subsample for analysis.

3.1.1 Volatile Organic Compounds

Selected VOCs (see Appendix A; Tables A-1 and A-5) will be analyzed using gas chromatography/mass spectrometry with purge and trap preconcentration, in accordance with EPA SW-846 Method 8260A (U.S. EPA 1986 and updates I and II) without modification.

3.1.2 Semivolatile Organic Compounds

Selected semivolatile organic compounds (i.e., selected ABN compounds) (see Appendix A; Tables A-1 and A-6) will be analyzed using gas chromatography/mass spectrometry in accordance with procedures specified by EPA SW-846 Method 8270 (U.S. EPA 1986 and updates I and II), as modified by PSEP (1989a). The PSEP modifications include the extraction of larger sample sizes (typically 50100 g wet weight), concentration to a smaller final extract volume (e.g., 0.5 mL), and demonstration of instrument sensitivity using low-level standards (e.g., 1–2 ng on-column). These modifications will be used to attain the project detection limits (see Appendix A; Table A-2). Also, all samples will be subjected to gel permeation chromatography cleanup procedures using EPA SW-846 Method 3640 (U.S. EPA 1986 and updates I and II). Gel permeation chromatography will be used to reduce interferences that may inhibit attaining the project detection limits specified in Appendix A (see Table A-2).

3.1.3 Chlorinated Pesticides/Polychlorinated Biphenyls

Chlorinated pesticides and total PCBs (see Appendix A; Table A-1) will be analyzed using the gas chromatography/electron capture detection technique specified by EPA SW-846 Method 8080, as modified by PSEP (1989a). The PSEP modifications include the extraction of larger sample sizes (typically 50-100 g, wet weight basis), concentration to a smaller final extract volume (e.g., 0.5 mL), and demonstration of instrument sensitivity using low-level standards. These modifications will be used to attain the project detection limits (see Appendix A; Table A-2). The sample extracts may be subjected to florisil column cleanup (EPA SW-846 Method 3610) and sulfur cleanup (EPA SW-846 Method 3660) to reduce potential interferences that may inhibit attaining the project detection limits specified in Appendix A (Table A-2).

3.1.4 Polychlorinated Dibenzo-*p*-Dioxins and Polychlorinated Dibenzofurans

Polychlorinated dibenzo-*p*-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) congeners (see Appendix A; Table A-8) will be analyzed using high resolution gas chromatography/high resolution mass spectrometry procedures specified by EPA SW-846 Method 8290 (U.S. EPA 1989). This method is based on the isotope dilution technique using isotopically labeled internal, surrogate, and recovery PCDD and PCDF standards. The recoveries of the isotopically labeled standards are used to correct the analytical results for losses of target compound concentrations that may occur during sample processing (e.g., extraction and cleanup procedures). Sample extract cleanup procedures specified in EPA SW-846 Method 8290 (U.S. EPA 1989) will be used to attain the project detection limits and to reduce potential interferences.

3.1.5 Metals

Selected metals (see Appendix A; Table A-1) will be analyzed by appropriate EPA SW-846 Methods (U.S. EPA 1986 and updates I and II), as modified by PSEP (1989b). Analyses will be conducted using inductively coupled plasma spectrometry and graphite furnace atomic absorption spectrometry, unless strong interferences are encountered or the limits of detection (see Appendix A; Table A-2) cannot be attained. For example, if a metal is undetected using the inductively coupled plasma spectrometry technique because of interferences or low concentrations, the graphite furnace atomic absorption technique will be substituted. Sediment and water samples will be subjected to a modified strong-acid digestion described in detail in PSEP (1989b). The strong-acid digestion technique uses nitric and hydrochloric acids and hydrogen peroxide. PSEP modifications yield results for most metals that are comparable with the alternative total metals digestion procedure discussed in PSEP (1989b). Mercury analyses of sediment and water will be conducted according to EPA SW-846 Method 7471 (U.S. EPA 1986 and updates I and II) using cold vapor atomic absorption spectrometry. Lead will be determined by graphite furnace atomic absorption spectrometry to achieve the target detection limits.

3.1.6 Total Volatile Solids

Total volatile solids will be analyzed in accordance with the procedures recommended by PSEP (1986b) without modification.

3.1.7 Total Sulfides

Total sulfides will be analyzed in accordance with the procedures recommended by PSEP (1986b).

3.1.8 Total Organic Carbon

Total organic carbon in sediment samples will be measured using procedures approved for used in the Sediment Management Standards program (Ecology 1993a), which is a modified version of Method 5310B (Franson 1992). This method includes wet oxidation and combustion to measure total organic carbon using infrared detection.

3.1.9 Ammonia

Ammonia will be analyzed following EPA Method 350.3 (U.S. EPA 1983), a potentiometric method for the determination of ammonia in water. The sediment samples will be extracted with 2M potassium chloride prior to analysis.

3.1.10 Total Solids

Total solids will be analyzed in accordance with the procedures recommended by PSEP (1986b)

3.1.11 Grain-Size Distribution

Grain-size distributions will be determined in sediments on oxidized samples by wet-sieving samples with hydrogen peroxide, followed by dry-sieving the gravel and sand fractions (Plumb 1981; PSEP 1986b). The silt-clay fraction will be subdivided into silt and clay fractions using a pipette technique (Plumb 1981, Particle Size Method 2).

4. DATA REPORTING

The results of the sampling program and data analyses will be provided in a data report. Laboratory results will be tabulated for the various sampling stations. For those chemical constituents with PSDDA SLs, MLs, and BTs, comparisons will be made with those criteria to assess the likely suitability of the sediments for disposal at a PSDDA site. The potential need for biological testing (i.e., sediment toxicity tests and bioaccumulation bioassays) will be discussed, if appropriate.

Original data on chemical analyses and sediment conventional variables will be included in appendices to the final data report. A data quality assurance report will also be included as an appendix to the final data report.

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Figures

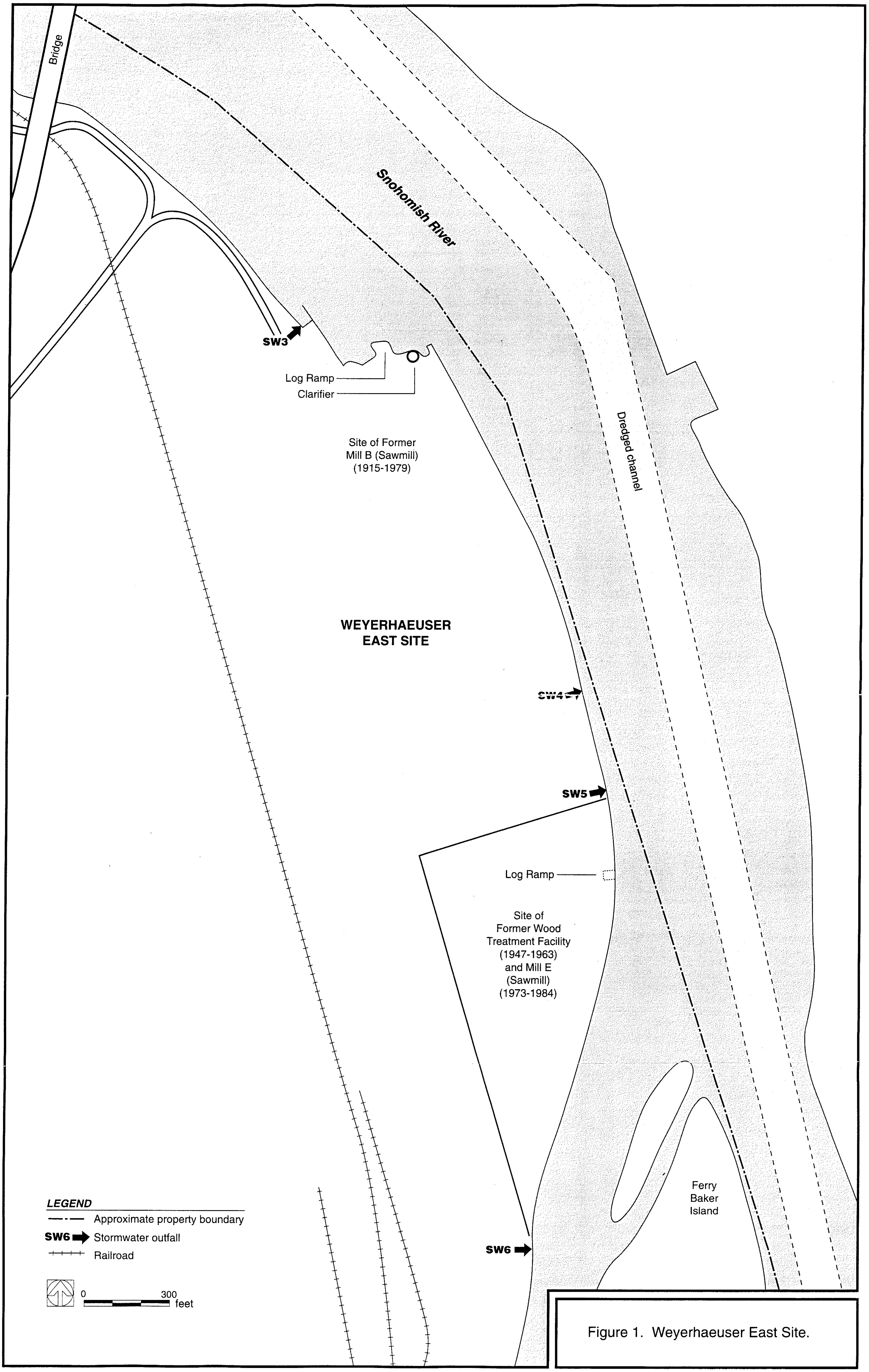

Figure 1. Weyerhaeuser East Site.

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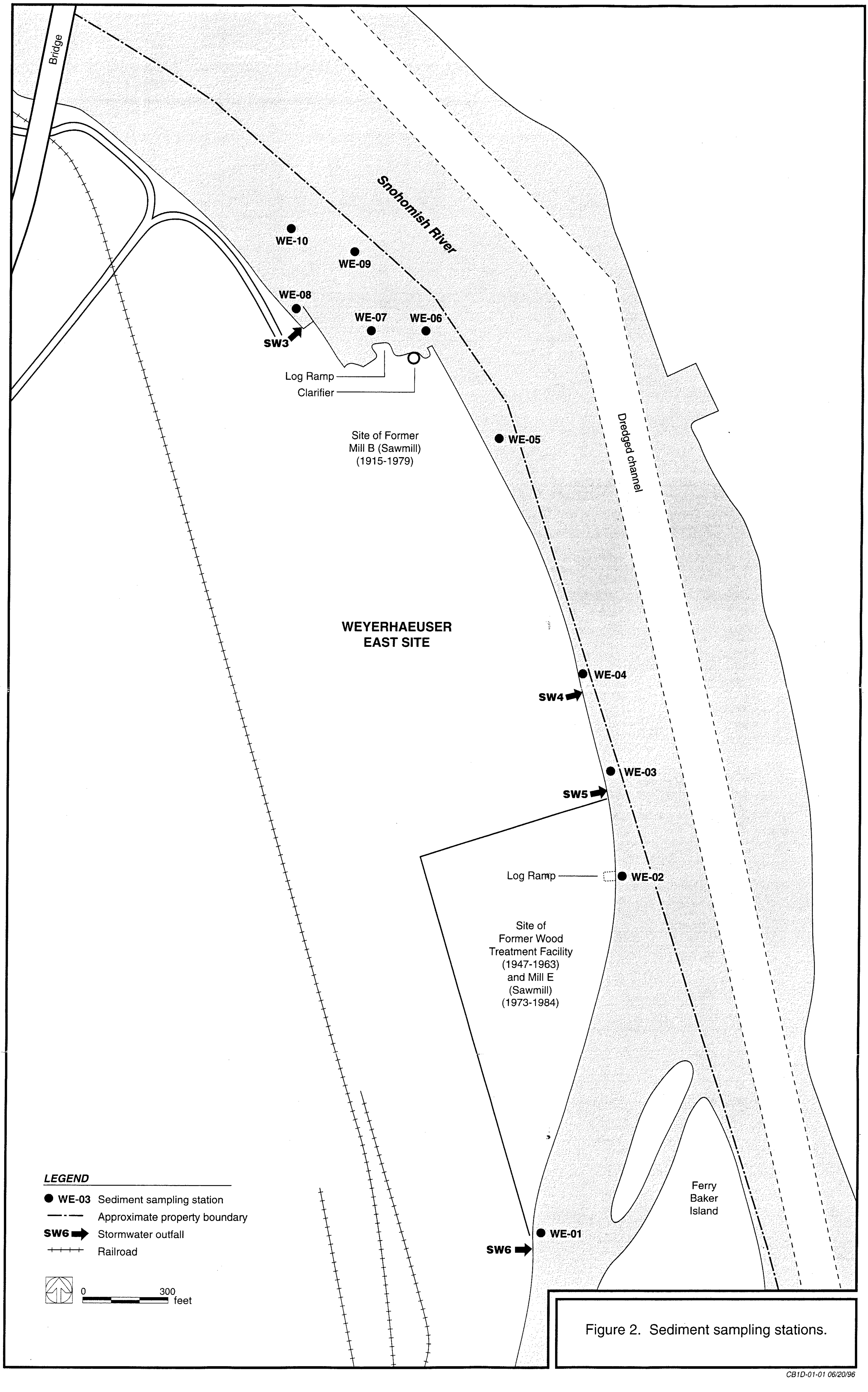

Figure 2. Sediment sampling stations.

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Appendix A

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

Prepared by: PTI ENVIRONMENTAL SERVICES
June 1996

Prepared for: Weyerhaeuser Paper Company

Approvals:

PTI Project Manager

PTI Quality Assurance Coordinator

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ACRONYMS AND ABBREVIATIONS

ABN	acid/base/neutral
BT	bioaccumulation trigger
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatography/mass spectrometry
GFAA	graphite furnace atomic absorption spectrometry
GPC	gel permeation chromatography
ICP	inductively coupled plasma-atomic emission spectrometry
ML	maximum level
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
PSDDA	Puget Sound Dredged Disposal Analysis
PTI	PTI Environmental Services
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
RPD	relative percent difference
RSD	relative standard deviation
SAP	sampling and analysis plan
SL	screening level
SOP	standard operating procedure
SOW	statement of work
TOC	total organic carbon
TVS	total volatile solids
VOC	volatile organic compound

1. PROJECT DESCRIPTION

This quality assurance project plan (QAPP) was prepared by PTI Environmental Services (PTI) to addresses the data quality objectives (DQOs) and the major quality assurance and quality control (QA/QC) considerations for the preliminary sediment assessment for Puget Sound Dredged Disposal Analysis (PSDDA) parameters at Weyerhaeuser's East Site in Everett, Washington. This QAPP was developed using guidance provided by U.S. EPA (1989a). The field and laboratory investigations are described in the sampling and analysis plan (SAP).

Selected chemical analyses will be performed on sediment samples collected at the site. The chemical target analytes include selected volatile organic compounds (VOCs); selected semivolatile acid/base/neutral (ABN) compounds; total polychlorinated biphenyls (PCBs) and chlorinated pesticides; polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs); selected metals; ammonia; total volatile solids (TVS); total sulfides; total organic carbon (TOC); total solids; and grain-size distribution. All chemical analyses will be performed in accordance with procedures outlined in the U.S. Environmental Protection Agency's (EPA) analytical methods (U.S. EPA 1983, 1986), as modified by procedures recommended by the Puget Sound Estuary Program (PSEP 1986; 1989a,b). The analytical procedures are discussed in Section 7 of this QAPP.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The responsibilities of project personnel and the laboratory quality assurance officer for specific laboratory and data analysis tasks are as follows:

Personnel	Responsibilities
PTI Project Manager (Lawrence McCrone)	Oversee all program activities and quality assurance reviews to ensure contract compliance; provide technical oversight.
PTI QA/QC Coordinator (James McAteer)	Provide technical quality assurance assistance; prepare, review, and initially approve QAPP; arrange contract or other external procurement packages for quality assurance needs; direct implementation of contractor quality assurance plan; prepare and submit quality assurance project reports to management.
Laboratory Quality Assurance Officer (Dennis Catalano, Weyerhaeuser Laboratory)	Ensure that sample receipt and custody records are properly handled; calibrate and maintain instruments as specified; perform internal quality control measures and analytical methods as required; take appropriate corrective actions; notify QA/QC coordinator when problems occur; report data and quality assurance information.

The laboratory quality assurance officer at the Weyerhaeuser Analytical Laboratory shall ensure that appropriate procedures are followed during sample analysis and preparation of the data package. As an additional quality control measure, PTI will prepare a statement of work (SOW) for the Weyerhaeuser Analytical Laboratory (although the Weyerhaeuser Paper Company will contract directly with the Weyerhaeuser Analytical Laboratory for these analyses) that specifies the following items:

- Summary of analyses, including:
    - A scope of services that lists all variables for analysis
    - The total number of field samples and laboratory quality assurance samples, the per analysis price, and total cost of the analytical service provided for each sample matrix and analysis requested
- Sample delivery and storage, including:
    - Method of delivery, weekly schedule of samples, and person responsible for notifying the laboratory of any changes in the schedule
    - Requirements for physical storage of samples, maximum holding times (consistent with this QAPP), chain-of-custody, and sample logbook procedures
- Turnaround time from date of sample delivery, including penalties for late delivery
- Deliverable requirements, including supporting documentation and specification of any electronic data files (if required)
- Methods to be followed, including any modification from standard procedures
- QA/QC requirements, including acceptance of the DQOs specified in this QAPP, and performance evaluation testing requirements.

A copy of the SOW for the laboratory will be provided to all quality assurance reviewers to assist in the review of data generated by the laboratory.

No changes in the procedures in the QAPP will be permitted without written documentation of the reason and a detailed explanation of the intended changes. All changes are subject to prior approval by the PTI QA/QC coordinator, in consultation with the PTI Project Manager.

3. QUALITY ASSURANCE OBJECTIVES AND SAMPLING STRATEGY

The overall quality assurance objective for this project is to ensure the collection of representative data of known and acceptable quality. The determination of the DQOs to support this objective is based on the expected use of the data for comparisons with the PSDDA program's screening levels (SLs), maximum levels (MLs), and bioaccumulation trigger values (BTs) (a list of the specific chemicals for which these criteria exist is provided in Table A-1). In addition, the sediment samples will be analyzed for certain other chemicals (e.g., PCDDs, PCDFs) for which SLs, MLs, and BTs have not been established.

3.1 DATA QUALITY OBJECTIVES

A summary of the specific DQOs to support the overall objective of this project is provided in Table A-2. Attainment of these quantitative DQOs will ensure that the data collected are sufficient and of adequate quality for their intended uses. Otherwise, data that do not meet DQOs will be qualified during data validation, and their limitations will be noted.

Quality assurance objectives for measurement data are usually expressed in terms of accuracy (bias and precision), completeness, representativeness, and comparability. Definitions of these characteristics are as follows:

- **Bias**—The degree of conformity of a measurement (or an average of measurements of the same parameter), X, with an accepted reference value, T, expressed as a percentage of a ratio, X/T × 100. Bias is one component of the accuracy of measurements.

- **Precision**—A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is expressed in terms of the relative standard deviation (RSD) for three or more measurements or the relative percent difference (RPD) for two measurements. Various measures of precision exist, including laboratory and field duplicate measurements. Precision is the second component of the accuracy of measurements, and the formula is defined in Section 12.0.

- **Completeness**—A measure of the amount of valid data expressed as a percentage obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions. Field and analytical data may be specified at different completeness levels. The formula for completeness is provided in Section 12.0.

- **Representativeness**—The degree with which data accurately and precisely represent the true value of a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

- **Comparability**—The confidence with which one data set can be compared with another. All data in a particular data set will be obtained by the same methods to ensure comparability of the results. Analytical comparability will be accomplished by analysis of samples.

3.2 SAMPLING AND ANALYSIS STRATEGY

The sampling strategy for obtaining data that meet the project objectives is described in the SAP. DQOs for accuracy and precision will be achieved by using both field and laboratory quality control samples. The field quality is measured by replicates and field blanks. Replicate field samples will be collected and submitted blind to the laboratory. In the laboratory, quality control samples include matrix spike samples and sample duplicates, as well as laboratory control samples and blanks. The field replicate results will be used to assess field variability. A summary of the DQOs for the parameters described above is presented in Table A-2.

4. SAMPLING PROCEDURES

The quality of the data collected in an environmental study depends on the quality of the sampling activities. Detailed procedures for sample collection and handling are specified and documented in the SAP. The following section provides a description of general sampling procedures and strategies.

4.1 SAMPLE COLLECTION, HANDLING, AND PRESERVATION

Tables A-3 and A-4 summarize sample collection, handling, and analysis procedures by matrix for each analytical method. Specific procedures that are described in the SAP include the following:

- Procedures for documenting the location of stations
- Standard operating procedures (SOPs) for collecting and compositing samples
- Steps for processing samples to ensure proper subsampling of each matrix
- Procedures for decontaminating equipment, work surfaces, and implements prior to commencing sampling and between each sampling event
- Completion of field forms (e.g., chain-of-custody records)
- Documentation of field techniques and sample custody in field logbooks and other field collection forms.

Sample containers will be kept closed and in a cooler (if necessary) until used. As they are collected, samples will be fully labeled, recorded in the field logbook along with other pertinent collection data, and returned to coolers as soon as possible.

Field replicates will be clearly identified on the summary sampling log, but will be submitted to the laboratory as blind samples. The following additional criteria will be implemented for the chemical samples to ensure that the resulting data are representative of environmental conditions, are comparable to existing data from the site, and address detection limits commensurate with the data uses:

- Samples will be of sufficient size to attain detection limits and analyze field replicate samples and laboratory quality control samples
- Subsamples will be taken from well-homogenized composite samples
- Verification that each sample is isolated from point source and cross contamination during sampling will be accomplished by using equipment rinsate blanks
- Subsamples will be placed in appropriate containers (e.g., chemically cleaned glass with Teflon®-lined lids) and held under appropriate conditions
- Samples will be identified in a manner to avoid the use of equipment rinsate blanks as laboratory quality control samples
- Modifications to the field sampling procedures will be documented and identified as a change from the intended method.

Complete records of all sampling, as described in the SAP, will be kept. For all sampling events, a summary sampling log will be completed at the end of each day of sampling. If a significant deviation from the SAP is being considered because of conditions encountered during sampling, the chief scientist will notify the PTI project manager or the

Weyerhaeuser project manager. The sampling crew will be provided with a portable cellular telephone to allow rapid and direct consultation.

5. SAMPLE CUSTODY

Sample custody is a critical element of environmental investigations, even when the data may not be specifically intended for use in litigation. Sample custody helps establish legal defensibility through traceability and documentation of sample integrity. The possession and proper handling of samples must be traceable from the time the samples are collected until the data have been accepted for analysis so that reanalyses may be conducted without concern for possible introduction of contaminants.

5.1 FIELD SAMPLING OPERATIONS

The most important aspect of sample custody is thorough recordkeeping. A sample label will be completed for each sample collected. Sample containers will be labeled with the following information:

- Sample number
- Sampling date
- Initials of sampling personnel
- Preservative, if appropriate
- Tag number.

At the time of sampling, the sample number and tag number for each subsample will be recorded on the sample log form. At the end of each day of sampling and prior to shipping or storage, chain-of-custody records will be made for all samples using the form shown in Appendix C. Information on the labels will be checked against sample log entries, and samples will be recounted. All changes to chain-of-custody forms will be made by striking out the error with one line and re-entering the correct information. The new entries will be initialed and dated.

5.2 SHIPPING

All samples will be accompanied by chain-of-custody forms and sample analysis request forms. The original, signed chain-of-custody form (enclosed in plastic) will be taped to the inside lid of the cooler. Each cooler will be securely closed by wrapping fiber tape completely around it. Labels indicating the proper orientation of the cooler will be attached to each side of the cooler, a Fragile-Glass label will be attached to the top of all coolers containing glass bottles, and the cooler will be sealed with a custody seal. Packaging will conform to U.S. Department of Transportation regulations. SOPs for sample packaging and shipping are included in Sampling Packaging and Shipping (Appendix B).

5.3 LABORATORY

The quality assurance officer at the laboratory will ensure that chain-of-custody records are completed when the samples are received at the laboratory and will note any questions or observations concerning sample integrity. The quality assurance officer will ensure that a sample-tracking record is maintained. This form will follow each sample through all stages of laboratory processing. These records will be used to determine compliance with maximum holding time requirements.

6. CALIBRATION PROCEDURES

Calibration procedures will be in accordance with requirements established by the analytical methods selected for the project; a summary of the analytical methods that will be used is provided in Section 7.0.

Instrument calibration will follow the procedures in the referenced analytical methods. All primary chemical standards and standard solutions used for this project will be traceable to the National Institute of Standards and Technology; the EPA Repository at Research Triangle Park, North Carolina; or other documented, reliable, commercial sources. Impurities noted in the standard will be documented; standards that are less than 94-percent pure will be rejected. Reagents will be examined for purity by performing method blank analyses.

All sample extractions, instrument calibrations, and sample analyses will be performed in accordance with procedures described in Section 7.0.

7. ANALYTICAL PROCEDURES

Analytical procedures will be in accordance with requirements specified in the selected methods. All analyses for organic and inorganic compounds, except for conventional parameters, will be performed in accordance with procedures established by EPA SW-846 Methods (U.S. EPA 1986), as modified by PSEP (1989a,b). Conventional analyses (i.e., ammonia, total sulfides, TOC, total solids, TVS, and grain-size distribution) will be performed in accordance with standard methods, as specified by PSEP (1986) or U.S. EPA (1983).

Analytical procedures for each compound class are summarized below. For sediment samples, the laboratory shall assume that the entire sample submitted for analysis is representative material. To avoid substance losses, any overlying water in sediment samples received from the field will be mixed into the sample before removal of a subsample for analysis.

7.1 VOLATILE ORGANIC COMPOUNDS

Selected VOCs (Tables A-1 and A-5) will be analyzed using gas chromatography/mass spectrometry (GC/MS) with purge and trap preconcentration, in accordance with EPA SW-846 Method 8260 (U.S. EPA 1986 and updates I and II) without modification.

7.2 SEMIVOLATILE ORGANIC COMPOUNDS

Selected semivolatile ABN compounds (Tables A-1 and A-6) will be analyzed using GC/MS in accordance with procedures specified by EPA SW-846 Method 8270 (U.S. EPA 1986), as modified by PSEP (1989a). The modifications include the extraction of larger sample sizes (typically 50-100 g, wet weight basis), concentration to a smaller final extract volume (e.g., 0.5 mL), and demonstration of instrument sensitivity using low-level standards (e.g., 1-2 ng on-column). These modifications will be used to attain the project detection limits (Table A-2). Also, all samples will be subjected to gel permeation chromatography (GPC) cleanup procedures using EPA SW-846 Method 3640 (U.S. EPA 1986). GPC will be used to reduce interferences that may inhibit attaining the project detection limits specified in Table A-2.

7.3 CHLORINATED PESTICIDES/POLYCHLORINATED BIPHENYLS

Chlorinated pesticides (Table A-7) and total PCBs will be analyzed using the gas chromatography/electron capture detection technique specified by EPA SW-846 Method 8080 (U.S. EPA 1986), as modified by PSEP (1989a). The modifications include the extraction of larger sample sizes (typically 50-100 g, wet weight basis), concentration to a smaller final extract volume (e.g., 0.5 mL), and demonstration of instrument sensitivity using low-level standards. These modifications will be used to attain the project detection limits (Table A-2). The sample extracts may be subjected to florisil column cleanup (EPA SW-846 Method 3610 [U.S. EPA 1986]) and sulfur cleanup (EPA SW-846 Method 3660 [U.S. EPA 1986]) to reduce potential interferences that may inhibit attaining the project detection limits specified in Table A-2.

7.4 POLYCHLORINATED DIBENZO-*P*-DIOXINS AND POLYCHLORINATED DIBENZOFURANS

PCDDs and PCDFs (Table A-8) will be analyzed using high resolution gas chromatography/high resolution mass spectrometry procedures specified by EPA SW-846 Method 8290 (U.S. EPA 1989b). This method is based on the isotope dilution technique using isotopically labeled internal, surrogate, recovery, and recovery PCDD and PCDF standards. The recoveries of the isotopically labeled standards are used to correct the analytical results for losses of target compound concentrations that may occur during sample processing (e.g., extraction and cleanup procedures). Sample extract cleanup procedures specified in EPA SW-846 Method 8290 will be used to attain the project detection limits and to reduce potential interferences.

7.5 METALS

Selected metals (Table A-1) will be analyzed by appropriate EPA SW-846 methods (U.S. EPA 1986), as modified by PSEP (1989b). Analyses will be conducted using inductively coupled plasma-atomic emission spectrometry (ICP) and graphite furnace atomic absorption spectrometry (GFAA), unless strong interferences are encountered or the limits of detection (Table A-2) cannot be attained. For example, if a metal is undetected using the ICP technique because of interferences or low concentrations, the GFAA technique will be substituted. Sediment and water samples will be subjected to a modified strong-acid digestion described in detail in PSEP (1989b). The strong-acid digestion technique uses nitric and hydrochloric acids and hydrogen peroxide. These modifications yield results for most metals that are comparable with the alternative total metals digestion procedure discussed in PSEP (1989b). Mercury analyses of sediment and water will be conducted according to EPA SW-846 Method 7471 (U.S. EPA 1986) using cold vapor atomic absorption spectrometry. Lead will be determined by GFAA to achieve the target detection limits.

7.6 TOTAL VOLATILE SOLIDS

TVS will be analyzed with the procedures recommended by PSEP (1986) without modification.

7.7 TOTAL SULFIDES

Total sulfides in sediment samples will be measured using procedures recommended by PSEP (1986).

7.8 TOTAL ORGANIC CARBON

TOC in sediment samples will be measured using procedures approved for use in the Sediment Management Standards program (Ecology 1993), which is a modified version of Method 5310B (Franson 1992). This method includes wet oxidation and combustion to measure TOC using infrared detection.

7.9 AMMONIA

Ammonia will be analyzed following EPA Method 350.3 (U.S. EPA 1983), a potentiometric method for the determination of ammonia in water. The sediment samples will be extracted with 2M potassium chloride prior to analysis.

7.10 TOTAL SOLIDS

Total solids in sediment samples will be analyzed in accordance with the procedures recommended by PSEP (1986) without modification.

7.11 GRAIN-SIZE DISTRIBUTION

Grain-size distribution will be determined in sediments on oxidized samples by wet-sieving samples with hydrogen peroxide, followed by dry-sieving the gravel and sand fractions

(Plumb 1981; PSEP 1986). The silt-clay fraction will be subdivided into silt and clay fractions using a pipette technique (Plumb 1981, Particle Size Method 2).

8. DATA VALIDATION, REDUCTION, AND REPORTING

The laboratory will be responsible for internal checks on data reporting and will correct errors identified during quality assurance review. PTI will be responsible for data validation, overall data management, and analysis of results. All data generated for the project will be subjected to Level III data review. A Level III data review consists of an assessment of data quality based on holding times; results of blank analyses; accuracy of matrix spike, matrix spike duplicate, and laboratory control samples; precision of matrix spike and duplicate matrix spike results; precision of field duplicate results; sample extraction efficiency in terms of surrogate compound recoveries; and the method detection limits reported by the laboratory.

The quality assurance review of the data will be performed using U.S. EPA (1994a,b) guidelines for inorganic and organic data. The quality assurance review of PCDD and PCDF data will be performed in accordance with specific quality control criteria specified in EPA SW-846 Method 8290 (U.S. EPA 1989b). Conventional parameters will be validated in accordance with procedures specified in Plumb (1981) and PSEP (1986). Data qualifiers defined in U.S. EPA (1994a,b) guidelines will be applied to the project data. All data will be validated in the context of DQOs specified in this QAPP.

The laboratory performing chemical analyses for this study will be required to report results that are supported by all information recommended for data validation and quality assurance review, including:

- A cover letter discussing procedures and analytical problems (if any)
- A summary of the results for all organic compounds, metals, biological, and conventional analyses performed

- Copies of laboratory notebook pages that list the final dilution volumes; sample extraction sizes; wet-to-dry ratios (i.e., total solids); and instrument detection limits for all organic compound, metals, and conventional analyses performed
- Analyte concentrations with reporting units identified
- Method blanks associated with each batch of samples and the total weight of each analyte in the method blanks
- Results for all QA/QC checks, including all laboratory spikes; laboratory duplicates; method blanks; and laboratory control samples for organic compounds, metals, and conventional analyses performed
- Data qualification codes and their definitions.

The laboratory shall maintain all calibration data summaries, including calibration ranges used for all organic compounds, metals, biological, and conventional variables, as well as quantification reports for GC/MS analyses and instrument printouts (including chromatograms, strip charts, printer tapes, and other documentation) for all instruments used to generate data. These data are to be stored by the laboratory in the event that a more detailed data validation may be required. A data validation report will be prepared as described in Section 14.0.

9. INTERNAL QUALITY CONTROL

The following sections summarize the procedures that will be used to assess quality during sample collection and laboratory analysis (e.g., frequency of replicates, spikes, blanks, surrogate samples, and reference materials). The procedures are based on the methods referenced in Section 7.0.

9.1 LABORATORY QUALITY CONTROL

The following samples will be generated at the analytical laboratory:

- **Calibration Verification**—Initial calibration of instruments will be performed at the start of the project and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in each analytical method (e.g., SW-846). Ongoing calibration verification will be performed as specified in the analytical methods to monitor instrument performance. In the event that an ongoing calibration is out of control, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications. Any project samples analyzed while the instrument was out of control will be reanalyzed.
- **Surrogate Spike Compounds**—Surrogate spikes (organic analyses only) are used to evaluate the recovery of an analyte from individual samples. All project samples to be analyzed for organic compounds, except for PCDD and PCDF compounds, will be spiked with appropriate surrogate compounds as defined in the analysis methods. Recoveries determined using these surrogate compounds will be

reported by the laboratory; however, the laboratory will not correct sample results using these recoveries.

- **Isotope Dilution for PCDD and PCDF Compounds**—The laboratory will spike all samples that will be analyzed for PCDD and PCDF compounds with labeled compounds to assess method performance on the sample matrix. The recovery of the isotopically labeled surrogate compounds will be used to recovery-correct all analytical results in accordance with procedures specified by SW-846 Method 8290.

- **Method Blanks**—Method blanks are used to assess possible laboratory contamination of samples associated with all stages of preparation and analysis of sample extracts. Blank corrections will not be applied by the laboratory to the original data. For organic compound analyses, a minimum of 1 method blank will be analyzed for every extraction batch, or 1 for every 20 samples, whichever is more frequent. For metals and conventional analyses, 1 method blank will be analyzed for every digestion batch, or 1 for every 20 samples, whichever is more frequent.

- **Matrix Spike Samples**—Matrix spike samples are analyzed to assess matrix effects on the accuracy of analytical measurements. Duplicate matrix spike samples are used to assess both accuracy and precision. For organic compounds (except semivolatiles), metals, and conventional analyses, a minimum of 1 matrix spike will be analyzed for each group of samples extracted or digested, or 1 for every 20 samples, whichever is more frequent. For organic compound analyses, 1 matrix spike duplicate will be analyzed for each group of samples extracted, or 1 for every 20 samples, whichever is more frequent.

- **Laboratory Control Samples**—When available, laboratory control samples will be used as a check on laboratory performance of metals and conventional analyses. For metals and applicable conventional analyses, 1 laboratory control sample will be analyzed for every digestion batch, or 1 for every 20 samples, whichever is more frequent. The source of the laboratory control sample must be included in the data package.

- **Laboratory Duplicates**—Laboratory duplicate analyses are indicators of laboratory precision. For metals and conventional analyses, 1 laboratory duplicate will be analyzed for every digestion batch, or 1 for every 20 samples, whichever is more frequent. Laboratory duplicate analyses are not required by SW-846 protocols for organic analyses.

- **Sample Container Preparation**—Sample container preparation procedures are summarized in Table A-3. Sample containers will be prepared by the laboratory and shipped to the project site, as required. Any containers that have visible signs of dirt or contamination will be discarded by the sampling personnel. Documentation of the preparation of sample containers will be prepared, signed, and dated by laboratory personnel and included with the sample container shipment. A copy of the sample container preparation documentation will be sent to PTI and included in the QA/QC report.

9.2 FIELD QUALITY CONTROL

The following samples will be prepared by sampling personnel in the field:

- **Equipment Rinsate Blanks**—Equipment rinsate blanks (e.g., cross-contamination blanks) will be used to help identify possible contamination from the sampling environment or from sampling equipment. A cross-contamination blank will be collected by collecting the deionized and distilled water that will be used to perform a final rinsate of the sampling equipment subsequent to final decontamination procedures. These blanks will be submitted for all analyses, except for grain-size distribution, as blind samples to the laboratory.

- **Field Replicates**—Field replicate samples will be analyzed to assess the variability of concentrations at a location. For all chemical analyses, field duplicates will be collected at a frequency of 1 per analytical method. All duplicate samples will submitted blind to the laboratory.

- **Reference Materials**—Analysis of reference materials provides information on the accuracy of the laboratory performing the analysis. National Institute for Standards and Technology or other audit samples will be used to demonstrate the ability of the laboratory to produce acceptable chemical results. In addition, at least one standard reference material will be sent from the field to be analyzed for each analyte group, depending on availability and on approval by the PTI QA/QC coordinator.

10. PERFORMANCE AND SYSTEM AUDITS

Performance and system audits for sampling and analysis operations consist of onsite reviews of field and laboratory quality assurance systems and equipment for sampling, calibration, and measurement. The laboratory is required to have written procedures addressing internal QA/QC; these procedures will be submitted to PTI and reviewed by the PTI QA/QC coordinator to ensure compliance with this QAPP.

All personnel engaged in sampling and analysis tasks will have appropriate training. Environmental monitoring equipment will be serviced periodically and calibrated each day during field use. Performance audit samples will be used to identify problems affecting data quality that may occur during sample processing, transfer, or analysis.

The PTI QA/QC coordinator will conduct external audits for the following activities:

- Field activities (sampling of sediments)
- Laboratory analyses (analytical methods, laboratory quality assurance procedures, and laboratory handling and documentation).

Performance audits may be conducted prior to and during the time the measurement system is generating data, as appropriate.

11. PREVENTIVE MAINTENANCE

Preventive maintenance of equipment is essential if project resources are to be used in a cost-effective manner. Preventive maintenance will take two forms: 1) a schedule of preventive maintenance activities to minimize downtime and ensure accuracy of measurement systems and 2) availability of critical spare parts and backup systems and equipment. The performance of these maintenance procedures will be documented in field and laboratory notebooks.

12. DATA ASSESSMENT PROCEDURES

Routine procedures to be used to measure precision and bias include replicate, method blank, and laboratory control sample analyses, and determination of completeness:

12.1 REPLICATE ANALYSIS

Precision for duplicate chemical analyses will be calculated as the RPD:

$$\mathrm{RPD} = \pm \frac{\mathrm{abs}\left[D_1 - D_2\right]}{\left(D_1 + D_2\right)/2} \times 100$$

where:

D_1 = sample value

D_2 = duplicate sample value.

Precision for the replicate will be calculated as the RSD:

$$\text{Percent RSD} = \frac{\sigma}{x} \times 100$$

where:

σ = standard deviation of three or more results

x = mean of three or more results.

12.2 MATRIX SPIKE ANALYSIS

Bias of these measurements will be calculated as the ratio of the measured value to the known spiked quantity:

$$\text{Percent recovery} = \frac{\text{measured quantity}}{\text{known quantity}} \times 100$$

12.3 METHOD BLANK ANALYSIS

Method blank results are assessed to determine the existence and magnitude of contamination. Guidelines for evaluating blank results and specific actions to be taken are identified in U.S. EPA (1994a,b). Sample results will not be corrected by subtracting a blank value.

12.4 LABORATORY CONTROL SAMPLE ANALYSIS

Bias of these measurements will be calculated as the ratio of the measured value to the referenced value:

$$\text{Percent recovery} = \frac{\text{measured value}}{\text{referenced value}} \times 100$$

12.5 COMPLETENESS

Completeness will be measured for each set of data received by dividing the number of valid measurements actually obtained by the number of valid measurements that were planned:

$$\text{Completeness} = \frac{\text{valid data points obtained}}{\text{total data points planned}} \times 100$$

To be considered complete, the data set must also contain all quality control check analyses that verify the accuracy (precision and bias) of the results.

13. CORRECTIVE ACTIONS

Corrective actions fall into two categories: 1) handling of analytical or equipment malfunctions and 2) handling of nonconformance or noncompliance with the quality assurance requirements that have been set forth. During field operations and sampling procedures, the field supervisor will be responsible for correcting equipment malfunctions. All corrective measures taken will be included in the field log, and if required, a sampling checklist summarizing all changes and the reasons for the changes will be completed.

The laboratory and data management quality assurance officers are responsible for corrective actions in their respective areas of involvement. Predetermined methods, limits of acceptability, and required sample handling methods are listed in Tables A-2, A-3, and A-4. Any corrective actions required to conform to the stated specifications will be recorded by the appropriate laboratory quality assurance officer and reported to the PTI QA/QC coordinator. Corrective actions will be documented in a project memorandum that specifies the samples concerned, acceptable data ranges, individual initiating corrective action, problem areas requiring corrective action and how they were detected, measures undertaken to correct the problems, and the individual approving the corrective action.

Corrective action documentation is routinely reviewed by the PTI corporate quality assurance officer, who has authority through the PTI President to enforce necessary corrective measures. In addition, laboratory contracts specify performance standards tied to the QAPP requirements that must be satisfactorily met for payment of invoices.

14. QUALITY ASSURANCE REPORTS

Quality assurance reports will be submitted to appropriate individuals in conjunction with the data reports submitted for the field investigation.

Reports summarizing field activities will contain copies of, or references to the following items:

- Summary of site sampling
- Station log
- Sample log
- Chain-of-custody forms and packing lists
- Corrective action reports
- System audit checklist
- Summary of any changes to procedures (and appropriate authorizations).

The QA/QC report from the quality assurance coordinator will summarize the data received and will note any significant quality assurance problems identified during the Level III data review. The report will include the following:

- Summary of overall data quality, including description of data that were qualified and completeness of the reported data
- Description of sample collection and holding time documentation
- Description of analytical methods

- Summary of method blank results
- Summary of the results reported for accuracy and precision measurements relative to the DQOs established for the project
- Summary of the results for field quality control measurements (i.e., equipment rinsate blanks and field duplicate samples)
- Evaluation of laboratory-reported detection limits relative to the DQOs established for the project.

Significant quality assurance problems that arise during the reporting period will be described. The quality assurance reports will be organized as follows:

- Summary of overall data quality, including description of data that were qualified
- Description of sample collection
- Description of analytical methods, including determination of detection limits
- Description of data reporting, including any corrections made for transcription or other reporting errors
- Description of completeness relative to QAPP objectives
- Description of precision relative to QAPP objectives
- Description of accuracy relative to QAPP objectives, including results of reference material analyses, matrix spikes, and surrogate recoveries
- Description of blank contamination for chemical analyses.

Data and any qualifiers applied to the data as a result of quality assurance review will be reported separately in the final data report.

15. REFERENCES

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U.S. EPA. 1986. Test methods for evaluating solid waste (SW-846): physical/chemical methods. U.S. Environmental Protection Agency, Office of Solid Waste, Washington, DC.

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U.S. EPA. 1994a. Contract Laboratory Program national functional guidelines for inorganic data review. EPA/540/R-94/013. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

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Tables

TABLE A-1. PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA) PROGRAM SEDIMENT CRITERIA

Chemical Parameter	Screening Level (SL)	Maximum Level (ML)	Bioaccumulation Trigger (BT)
Metals		(mg/kg dry weight)	
Antimony	20	200	146
Arsenic	57	700	507.1
Cadmium	0.96	9.6	--
Copper	81	810	--
Lead	66	660	--
Mercury	0.21	2.1	1.5
Nickel	140	--	1,022
Silver	1.2	6.1	4.6
Zinc	160	1,600	--
Nonionizable Organic Compounds		(μg/kg dry weight)	
Aromatic Hydrocarbons			
Total LPAH[a]	610	6,100	--
Naphthalene	210	2,100	--
Acenaphthylene	64	640	--
Acenaphthene	63	630	--
Fluorene	64	640	--
Phenanthrene	320	3,200	--
Anthracene	130	1,300	--
2-Methylnaphthalene	67	670	--
Total HPAH[b]	1,800	51,000	--
Fluoranthene	630	6,300	4,600
Pyrene	430	7,300	--
Benz[a]anthracene	450	4,500	--
Chrysene	670	6,700	--
Total benzofluoranthenes[c]	800	8,000	--
Benzo[a]pyrene	680	6,800	4,964
Indeno[1,2,3-cd]pyrene	69	5,200	--
Dibenz[a,h]anthracene	120	1,200	--
Benzo[ghi]perylene	540	5,400	--
Chlorinated Benzenes			
1,2-Dichlorobenzene	19	350	37
1,3-Dichlorobenzene	170	--	1,241
1,4-Dichlorobenzene	26	260	190
1,2,4-Trichlorobenzene	13	64	--
Hexachlorobenzene	23	230	168

TABLE A-1. (cont.)

Chemical Parameter	Screening Level (SL)	Maximum Level (ML)	Bioaccumulation Trigger (BT)
Nonionizable Organic Compounds (cont.)		(μg/kg dry weight)	
Phthalate Esters			
Dimethyl phthalate	160	--	1,168
Diethyl phthalate	97	--	--
Di-*n*-butyl phthalate	1,400	--	10,220
Butyl benzyl phthalate	470	--	--
Bis[2-ethylhexyl]phthalate	3,100	--	13,870
Di-*n*-octyl phthalate	6,200	--	--
Miscellaneous			
Dibenzofuran	54	540	--
Hexachlorobutadiene	29	290	212
Hexachloroethane	1,400	14,000	10,220
N-nitrosodiphenylamine	28	220	161
Total PCBs	130	2,500	38^{d}
Chlorinated Pesticides			
Total DDT	6.9	69	50
Aldrin	10	--	37
Chlordane	10	--	37
Dieldrin	10	--	37
Heptachlor	10	--	37
Lindane	10	--	--
Volatile Organic Compounds			
Ethylbenzene	10	50	27
Tetrachloroethene	14	210	102
Total xylene	12	160	--
Trichloroethene	160	1,600	1,168
Ionizable Organic Compounds		(μg/kg dry weight)	
Phenol	120	1,200	876
2-Methylphenol	20	72	--
4-Methylphenol	120	1,200	--
2,4-Dimethylphenol	29	50	--
Pentachlorophenol	100	690	504
Benzyl alcohol	25	73	--
Benzoic acid	400	690	--

Notes on next page.

TABLE A-1. (cont.)

Note:	
--	- no numerical criterion of this type for this chemical
BT	- bioaccumulation trigger
DDT	- dichlorodiphenyltrichloroethane
HPAH	- high molecular weight polycyclic aromatic hydrocarbon
LPAH	- low molecular weight polycyclic aromatic hydrocarbon
ML	- maximum level
PCB	- polychlorinated biphenyl
SL	- screening level

Where laboratory analysis indicates a chemical is not detected in a sediment sample, the detection limit should be reported. Where chemical criteria in this table represent the sums of individual compounds (e.g., total LPAHs and total HPAHs), isomers (e.g., total benzofluoranthenes), or groups of congeners (e.g., total PCBs), only the highest individual chemical detection limit in a group is reported when all chemicals in that group are undetected; when any chemicals in a group are detected, only the detected concentrations are included in the sum.

[a] The total LPAH criteria are to be compared to the sum of the concentrations of the following LPAH compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene. The total LPAH criteria are not the sums of the corresponding criteria listed for the individual LPAH compounds.

[b] The total HPAH criteria are to be compared to the sum of the concentrations of the following HPAH compounds: fluoranthene, pyrene, benz[a]anthracene, chrysene, total benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene. The total HPAH criteria are not the sums of the corresponding criteria listed for the individual HPAH compounds.

[c] The total benzofluoranthenes criteria are to be compared to the sums of the concentrations of the b, j, and k isomers of benzofluoranthene.

[d] The total PCBs BT value is in parts per million "normalized" on a total organic carbon basis (i.e., mg/kg organic carbon). To normalize to total organic carbon, the dry weight concentration of total PCBs in the sediment is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

TABLE A-2. SUMMARY OF DATA QUALITY OBJECTIVES

Variable	Matrix	Units	Detection Limit Goals	Quantification Limit Goalsa	Bias (percent)	Precision (RPD)	Completeness (percent)	Holding Time (days)
Organic Analyses								
Selected volatile organic compounds	Sediment	μg/kg	2–10	10	100±50	±50	95	5^b
Selected semivolatile organic compounds	Sediment	μg/kg	10–50	40–200	100±50	±50	95	5b
Chlorinated pesticides	Sediment	μg/kg	0.1–1	2	100±50	±50	95	5^b
Total polychlorinated biphenyls	Sediment	μg/kg	1–5	24	100±50	±50	95	5b
Polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans								
Tetra congeners	Sediment	μg/kg	0.0001–0.005	0.0005	100±30	±25	95	5b
Penta congeners	Sediment	μg/kg	0.0001–0.005	0.0025	100±30	±25	95	5b
Hexa congeners	Sediment	μg/kg	0.0001–0.005	0.0025	100±30	±25	95	5b
Hepta congeners	Sediment	μg/kg	0.0001–0.005	0.0025	100±30	±25	95	5b
Octa congeners	Sediment	μg/kg	0.0001–0.005	0.0025	100±30	±25	95	5b
Metals Analyses								
Arsenic	Sediment	mg/kg	--	4	100±25	±35	95	180
Cadmium	Sediment	mg/kg	--	2	100±25	±35	95	180
Chromium	Sediment	mg/kg	--	4	100±25	±35	95	180
Copper	Sediment	mg/kg	--	10	100±25	±35	95	180
Lead	Sediment	mg/kg	--	1.2	100±25	±35	95	180
Mercury	Sediment	mg/kg	--	0.1	100±25	±35	95	28
Silver	Sediment	mg/kg	--	4	100±25	±35	95	180
Zinc	Sediment	mg/kg	--	8	100±25	±35	95	180
Conventional Analyses								
Ammonia nitrogen	Sediment	mg/kg	--	1.0	100±25	±35	95	28 days
Total sulfides	Sediment	mg/kg	--	1	±25	±20	95	28

TABLE A-2. (cont.)

Variable	Matrix	Units	Detection Limit Goals	Quantification Limit Goalsa	Bias (percent)	Precision (RPD)	Completeness (percent)	Holding Time (days)
Conventional Analyses (cont.)								
Total organic carbon	Sediment	mg/kg	--	1	±25	±20	95	180
Total solids	Sediment	percent	--	0.1 percent	NA	±10	95	6 months
Total volatile solids	Sediment	percent	--	0.1 percent	NA	±10	95	6 months
Grain size	Sediment	percent	--	--	±10	±10	95	28

a Quantification limit goals are given for a dry-weight basis assuming 50-percent moisture.

b Samples must be extracted within the specified number of days and extracts must be analyzed within 40 days following extraction.

TABLE A-3. SAMPLE CONTAINERS, PREPARATION, AND PRESERVATIVES

Parameter Group	Container	Matrix	Container Preparation	Preservative and Handling
Semivolatile ABN compounds, chlorinated pesticides, PCBs, and PCDDs/PCDFs	250-mL wide mouth glass jar; TFEa-lined lid	Sediment	Detergent wash; acid, deionized water, and solvent rinses; oven dry at 105°C	Keep in dark; cool (4°C)
Volatile organic compounds	120 mL wide mouth glass jar; TFE-lined lid	Sediment	Detergent wash; acid, deionized water, and solvent rinses; oven dry at 105°C	Cool (4°C)
Total sulfides	125-mL high-density polyethylene jar	Sediment	Detergent wash; acid rinse, multiple deionized water rinses; air dry	Fill, leaving no headspace; keep in dark; freeze (-20°C)
Total organic carbon	125-mL high-density polyethylene jar	Sediment	Detergent wash; acid, deionized water, and solvent rinses; oven dry at 105°C	Keep in dark; freeze (-20°C)
Metals	250-mL high-density polyethylene jar	Sediment	Detergent wash; acid rinse; multiple deionized water rinses; air dry	Cool (4°C)
Grain size	250-mL high-density polyethylene jar	Sediment	Detergent wash; deionized water rinse; air dry	Cool (4°C)
Ammonia	125 mL high-density polyethylene jar	Sediment	Detergent wash; acid rinse, multiple deionized water rinses; air dry	Cool (4°C)
Total solids	125 mL high-density polyethylene jar	Sediment	Detergent wash; acid rinse, multiple deionized water rinses; air dry	Cool (4°C)
Total volatile solids	125 mL high-density polyethylene jar	Sediment	Detergent wash; acid rinse, multiple deionized water rinses; air dry	Cool (4°C)

Note: ABN - acid/base/neutral
PCB - polychlorinated biphenyl
PCDD - polychlorinated dibenzo-*p*-dioxin
PCDF - polychlorinated dibenzofuran
TFE - tetrafluoroethylene

TABLE A-4. SAMPLE PREPARATION AND ANALYSIS METHODS

Analyte	Matrix	Approximate Laboratory Subsample[a]	Sample Preparation	Method Type	Method Reference
Organic Analyses					
Volatile organic compounds	Sediment	10 g	Purge and trap	GC/MS	EPA Method 8260A
Semivolatile ABN compounds	Sediment	50–100 g	Ultrasonic extraction	GC/MS	SW-846 Method 8270; modified by PSEP (1989a)
Total Chlorinated pesticides/PCBs	Sediment	50–100 g	Soxhlet extraction	GC/ECD	SW-846 Method 8080; modified by PSEP (1989a)
PCDDs and PCDFs	Sediment	10–30 g	Soxhlet extraction	HRGC/HRMS	SW-846 Method 8290
Metals Analyses					
Antimony, arsenic, cadmium, copper, lead, mercury, nickel, silver, and zinc	Sediment	1 g	HNO_3-H_2O_2/HNO_3-HCL digestion	ICP/GFAA/CVAA	SW-846 Method 6010 and 7000-series methods, as modified by PSEP
Conventional and Physical Analyses					
Ammonia	Sediment	20 g	Liquid extraction	Potentiometry	EPA Method 350.3 (U.S. EPA 1983), modified for sediment
Total sulfides	Sediment	15 g	Acidification with H_2SO_4	Titration	PSEP (1986)
Total organic carbon	Sediment	1 g	None	Combustion	Franson (1992)
Total solids	Sediment	25 g	None	Gravimetry	PSEP (1986)
Total volatile solids	Sediment	25 g	None	Gravimetry	PSEP (1986)
Grain size	Sediment	250 g	None	Sieve	Plumb (1981)

Note: Specific method descriptions are provided in Section 7.0.

ABN - acid/base/neutral
CVAA - cold vapor atomic absorption spectrometry
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
GFAA - graphite furnace atomic absorption spectrometry
HRGC - high resolution gas chromatography
HRMS - high resolution mass spectrometry
ICP - inductively coupled plasma-atomic absorption spectrometry
PCB - polychlorinated biphenyl
PCDD - polychlorinated dibenzo-*p*-dioxin
PCDF - polychlorinated dibenzofuran
PSEP - Puget Sound Estuary Program

[a] Approximate laboratory subsample refers to amount of sample analyzed in the laboratory.

TABLE A-5. TARGET ANALYTE LIST FOR VOLATILE ORGANIC COMPOUNDS

Trichloroethene
Tetrachloroethene
Ethylbenzene
Total xylenes

TABLE A-6. TARGET ANALYTE LIST FOR SEMIVOLATILE ACID/BASE/NEUTRAL AND GUAIACOL COMPOUNDS

Phenols

- Phenol
- 2-Methylphenol
- 4-Methylphenol
- 2,4-Dimethylphenol

Substituted Phenols

- 2-Chlorophenol
- 2,4-Dichlorophenol
- 4-Chloro-3-methylphenol
- 2,4,6-Trichlorophenol
- 2,4,5-Trichlorophenol
- Pentachlorophenol
- 2-Nitrophenol
- 2,4-Dinitrophenol

Low Molecular Weight Aromatic Hydrocarbons

- Naphthalene
- 2-Methylnaphthalene
- Acenaphthylene
- Acenaphthene
- Fluorene
- Phenanthrene
- Anthracene

High Molecular Weight Polycyclic Aromatic Hydrocarbons

- Fluoranthene
- Pyrene
- Benz[a]anthracene
- Chrysene
- Benzo[b]fluoranthene
- Benzo[k]fluoranthene
- Benzo[a]pyrene
- Indeno[1,2,3-cd]pyrene
- Dibenz[a,h]anthracene
- Benzo[ghi]perylene

Chlorinated Aromatic Hydrocarbons

- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2-Dichlorobenzene
- 1,2,4-Trichlorobenzene
- 2-Chloronaphthalene
- Hexachlorobenzene

Chlorinated Aliphatic Hydrocarbons

- Hexachloroethane
- Trichlorobutadiene isomers
- Tetrachlorobutadiene isomers
- Pentachlorobutadiene isomers
- Hexachlorobutadiene
- Hexachlorocyclopentadiene

Halogenated Ethers

- Bis[2-chloroethyl]ether
- Bis[2-chloroisopropyl]ether
- Bis[2-chloroethoxy]methane
- 4-Chlorophenyl-phenylether
- 4-Bromophenyl-phenylether

Phthalates

- Dimethyl phthalate
- Diethyl phthalate
- Di-*n*-butyl phthalate
- Butylbenzyl phthalate
- Bis[2-ethylhexyl]phthalate
- Di-*n*-octyl phthalate

Miscellaneous Oxygenated Compounds

- Isophorone
- Benzyl alcohol
- Benzoic acid
- 2,3,7,8-tetrachlorodibenzo-*p*-dioxin
- Dibenzofuran

Organonitrogen Compounds

- Aniline
- Nitrobenzene
- N-nitroso-di-*n*-propylamine
- 4-Chloroaniline
- 2-Nitroaniline
- 3-Nitroaniline
- 4-Nitroaniline
- 2,6-Dinitrotoluene
- 2,4-Dinitrotoluene
- N-nitrosodiphenylamine
- 1,2-Diphenylhydrazine
- Benzidine (4,4′-diaminobiphenyl)
- 3,3′-Dichlorobenzidine

Guaiacols

- 3-methoxyphenol
- 3,4,5-Trichloroguaiacol
- 4,5,6-Trichloroguaiacol
- Tetraguaiacol

TABLE A-7. TARGET ANALYTE LIST FOR CHLORINATED PESTICIDES

Total DDTs
Heptachlor
Alpha-chlordane
Aldrin
Dieldrin
Lindane

TABLE A-8. U.S. ENVIRONMENTAL PROTECTION AGENCY METHOD 8290[a] TARGET ANALYTES

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)
2,3,7,8-Tetrachlorodibenzofuran (TCDF)
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin (PeCDD)
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
2,3,4,7,8-Pentachlorodibenzofuran
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
1,2,3,6,7,8-Hexachlorodibenzofuran
1,2,3,7,8,9-Hexachlorodibenzofuran
2,3,4,6,7,8-Hexachlorodibenzofuran
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
1,2,3,4,7,8,9-Heptachlorodibenzofuran
Octachlorodibenzo-*p*-dioxin (OCDD)
Octachlorodibenzofuran (OCDF)
Total TCDDs
Total TCDFs
Total HpCDDs
Total HpCDFs
Total PeCDDs
Total PeCDFs
Total HxCDDs
Total HxCDFs

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[a] U.S. EPA (1989b).

Appendix B

Standard Operating Procedures

STANDARD OPERATING PROCEDURE

SAMPLE PACKAGING AND SHIPPING

For samples collected during field operations that will be classified as "environmental." Specific sample packaging and shipping requirements are described below.

ENVIRONMENTAL SAMPLES

All samples identified as Environmental Samples should be packaged and/or shipped utilizing the following procedures.

Packaging

1. Place samples into a strong container, such as a lined cooler or a U.S. Department of Transportation (DOT)-approved fiberboard box. The inside of the container should be lined with a polyethylene bag. Wrap glass jars with bubble-pack and surround the samples with noncombustible, absorbent, cushioning material for stability during transport.
2. Seal the large polyethylene bag with two chain-of-custody seals.
3. Place the laboratory/sampling (including chain-of-custody) paperwork in a large envelope and tape it to the inside lid of the shipping container (see Shipping Papers).
4. Close and seal the outside container with several chain-of-custody seals. Tape it shut using fiberglass tape.

Marking/Labeling

1. Use abbreviations only where specified.
2. Place the following information, either hand-printed or in label form, on the outside container:
    - Laboratory name and address
    - Return name and address.

3. Print "Environmental Samples" and "This End Up" clearly on top of the shipping container. Put upward pointing arrows on all four sides of the container. No other marking or labeling is required.

Shipping Papers

No DOT shipping papers are required. The following sample custody and analytical laboratory request forms should accompany the sample shipment. These documents should be taped to the inside lid of the outside sample container:

- Chain-of-custody form
- Sample analytical request form
- Sample packing list.

See the quality assurance project plan for procedures in filling out these forms.

STANDARD OPERATING PROCEDURE

SAFETY DURING MARINE OPERATIONS

INTRODUCTION

PTI field projects often require the collection of biological, sediment, and water samples from vessels. In addition to the physical and chemical hazards associated with all field sampling, there are special hazards associated with vessels. This standard operating procedure provides guidance for ensuring the safety of PTI and subcontractor personnel when working on the water. These procedures address inland or protected waters only. Additional procedures are required for working on vessels offshore.

TRAINING

Appropriate training is essential for preventing accidents and ensuring the proper completion of all field duties. The following training requirements apply to all PTI field work conducted on the water:

- All PTI and subcontractor personnel must participate in an initial safety briefing prior to beginning the field work, whenever new personnel come aboard, and when conditions or tasks change.
- If the field project is conducted at a designated hazardous materials site or there is any potential for chemical exposure, then all PTI and subcontractor personnel must have the appropriate 40-hour hazardous waste operations training and current 8-hour annual refresher training. Supervisors must have completed the 8-hour supervisors training course.
- The field team leader, or site safety officer must have current first aid and CPR training.
- If the vessel is to be operated by PTI personnel, the operator must demonstrate proficiency in the operation of that type of vessel and knowledge of marine safety and navigation rules. Personnel without prior experience will be required to complete training in these subjects. (Note: This requirement is intended to apply to small craft only; PTI does not anticipate training personnel to operate large vessels.)

REQUIRED SAFETY EQUIPMENT

To prevent accidents and ensure adequate preparation for any emergencies that may arise, it is the responsibility of the PTI project manager to secure appropriate safety equipment for the duration of the project. This equipment must include the following:

- **Personal Flotation Devices (PFDs)**—There must be one PFD for every person onboard the vessel, plus an additional throwable flotation device for vessels over 16 ft in length.

- **Fire Extinguisher**—Requirements for fire extinguishers vary based on the vessel length and whether the vessel has inboard engines or closed compartments. Fire extinguishers are recommended for all motorized vessels. Additional information regarding requirements for fire extinguishers can be obtained from the U.S. Coast Guard.

- **First-Aid Kit**—A first-aid kit must be provided during all PTI field projects. The contents of the first-aid kit will vary based on the number of persons present, but at a minimum should include a variety of bandages and compresses, disinfectant, gloves, a CPR shield, eyewash, and an emergency blanket. Additional information regarding requirements for first-aid kits can be obtained from the applicable state or federal department responsible for occupational safety and health.

- **Marine Radio with Weather Channel**—A VHF radio is required by law on commercial vessels and is required by PTI for all work on Puget Sound or other open waters. The frequency and call sign of local emergency services must be posted on the vessel and be included in the site health and safety plan.

- **Cellular Telephone**—If a two-way VHF marine radio is not available then a cellular telephone must be onboard.

- **Horn or Bell**—U.S. Coast Guard regulations require a signaling device be onboard all vessels longer than 36 ft and require that all vessels, regardless of length, be capable of making audible signals during certain events (i.e., approaching or overtaking other vessels).

- **Navigation Lights**—The requirements for navigation lights vary based on the length and type of vessel. All vessels operated at night must have the appropriate navigation lights.

- **Oars or Paddles**—Small power boats should be equipped with alternate means of propulsion.

- **Anchor and Suitable Line**—In almost all cases, vessels should be equipped with one (or even two) anchors and sufficient anchor line for expected water depths and bottom conditions.

- **Flares**—A flare kit should be on board all field vessels.
- **Reach Pole or Shepard's Hook**—On larger vessels, a reach pole or shepard's hook must be provided to facilitate rescue of any persons who fall overboard.
- **Other Rescue Gear**—On larger vessels, a block and tackle or other means must be provided to pull a person from the water.

HAZARDS AND PREVENTION

There are many physical hazards associated with working onboard a vessel. Potential hazards and appropriate precautions are listed below:

- **Slips/Trips/Falls**—The combination of a moving vessel and wet or slippery decks increases the potential for slips, trips, or falls. These can be prevented by increasing your awareness of the surroundings, keeping one hand free for handholds and support, keeping the deck and working areas clear of unnecessary obstacles or hazards, and wearing nonskid boots or shoes.
- **Drowning**—Even the best swimmer can drown if caught unprepared, tired, or weighted down with bulky clothing and boots. Drowning can be prevented by taking precautions against falling overboard (avoid reaching over the side, beware of slips/trips/falls, avoid ondeck work in heavy seas) and by wearing a PFD. PFDs should be worn underneath chemical protective clothing such as tyvek coveralls (thus allowing the wearer to remove the coveralls without first removing the PFD) and should be properly secured or buckled.
- **Crushing/Falling Objects**—The use of hoists to lift coring tools and other equipment could result in crushing or other injuries to field workers. These injuries can be avoided by using properly adjusted and maintained hoists, allowing only experienced personnel to operate the hoist, keeping all personnel out of the way during lifting and hoisting, and by wearing hardhats to protect against head injuries or bumps.
- **Gear Deployment and Retrieval**—The deployment and retrieval of sampling gear presents a hazard because of the weight of the gear, its suspension over the deck, and the risk of entanglement or accidental and premature release or closure. Setting the triggering mechanism will always be performed when the equipment is resting on a stable surface. During sample retrieval, at least one crew member is required to watch for the appearance of the sampling gear and alert the winch operator. Failure to observe the sampling gear and stop the winch could lead to breakage of the cable, loss of the sampling gear, the hitting upside the head of the negligent observer, and possibly injury from either the falling gear or the

end of the broken cable. All nonessential personnel should stay clear of the work area during the retrieval and deployment of sampling gear. All personnel should be knowledgeable in the proper hand signals for guiding the winch operator.

- **Cables**—After repeated use, stainless steel cables may fray or break. Sampling personnel must never contact the moving cable unless they are wearing work gloves. Periodically during the sampling event, the site safety officer should inspect the cable for wear, especially where the wire or cable is attached to the sampling equipment.

- **Climate**—Depending on the climate, field personnel may suffer from hypothermia, dehydration, or heat stress. Climate-related illness and injuries can be prevented by dressing appropriately for the expected climate and by having additional clothing onboard should personnel get wet or the weather change suddenly. When working in cold, wet weather, appropriate clothing may include raingear, wool, and modern synthetics. Cotton clothing should only be worn during warm, dry weather. In addition, fluid replenishment beverages (to protect against heat stress and dehydration) or warm beverages (to protect against hypothermia) should be available during field work.

- **Unsecured Gear**—Wherever possible, all ondeck sampling and safety gear should be secured to a deck, rail, or bulkhead to prevent loss or unexpected movement resulting from wind or waves.

- **Hatches**—All personnel should be alerted to the presence of an open hatch, and hatches should not be left open unnecessarily.

- **Chemical and Sample Storage**—To prevent fire, health hazards, or sample contamination, all field chemicals such as solvents and formalin should be stored on deck, not in the cabin, hold, or near samples.

EMERGENCY PROCEDURES

In case of a boating-related injury or fatality, PTI personnel must:

- Notify emergency medical or rescue personnel immediately (as appropriate). (The U.S. Coast Guard emergency frequency is VHF Channel 16.)

- Notify the site safety officer, the appropriate PTI project manager, and the corporate health and safety officer immediately. The project manager and corporate health and safety officer will coordinate notifications to the Occupational Safety and Health Administration and the U.S. Coast Guard.

In case of boating-related property damage exceeding $200, PTI personnel must:

- Notify police or other legal jurisdiction (as appropriate).
- Notify the site safety officer, the appropriate PTI project manager, and the corporate health and safety officer within 48 hours of the incident. The project manager and corporate health and safety officer will coordinate notification of the U.S. Coast Guard.
- Notify the PTI business operations manager to initiate insurance claims.

Appendix C

Example Field Data Forms

PTI
ENVIRONMENTAL SERVICES

SAMPLE ANALYSIS REQUEST

For: ______________________________

Attention: ______________________________

Project: ______________ SAR Number: ______________ Date: ______________

PTI Contact: ______________________________

	Lab Code	Sample Tag	Sample No.	Matrix	Conc.	Preserv.	Date	Analyses (Digestion)
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
16.								
17.								
18.								
19.								
20.								

NOTES

Matrix:

Concentration:

Perservative:

Digestion:

PTI
ENVIRONMENTAL SERVICES

CHAIN-OF-CUSTODY RECORD

Project: ______________________ COC Form Number: ______________

Sampler (Signature): ______________________

Sample Tag	Sample No.	Date	Time	Matrix	Containers
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					

SAMPLE CUSTODY RECORDS
Every sample transfer must be signed by both parties involved.

Relinquished by	Received by	Date	Time

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: ____________ STATION: ____________ DATE: ____________ GEAR: ____________

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude		Sample No.	Tag No.		

TEXTURE:	Cobble	Gravel	Sand	Silt	Clay
COLOR:	Black	Brown		Grey	Green
ODOR:	Normal	Sewage	H_2S	Petroleum	None

COMMENTS:

PHOTO: Roll ____________ No: ____________

INITIALS: ____________

FF 11/22/95

Appendix D

Health and Safety Checklist

PTI ENVIRONMENTAL SERVICES

SITE SAFETY PLAN - SHORT FORM

Site Name Weyerhaeuser East Site, Everett, Washington

Project Number CB1D-02-01

Prepared by Lawrence McCrone Date 6/18/96

Reviewed by Greg Bawden Date 6/18/96

INTRODUCTION

This site-specific health and safety plan establishes procedures and practices to protect employees of PTI Environmental Services (PTI) and its subcontractors from potential hazards posed by field activities at the Everett site. In this health and safety plan, measures are provided to minimize potential exposure, accidents, and physical injuries that may occur during daily onsite activities and adverse conditions. Contingency arrangements are also provided for emergency situations.

DISCLAIMER

PTI does not guarantee the health or safety of any person entering this site. Because of the potentially hazardous nature of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury and illness at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior evaluation by trained health and safety personnel.

SITE DESCRIPTION (use additional pages if necessary)

Name of the site: Weyerhaeuser East Site

Site location or address: 101 East Marine View Drive
Everett, Washington

Owners/tenants: Weyerhaeuser Paper Company

Current site use: Minimal; administrative and site clean-up activities (i.e., removal of structures, regrading)

Past site use (if different): Saw mill; wood treatment facility

Designated hazardous waste site Yes ____ (federal, state, other) Included on the Washington State *Contaminated Sediment Site* list

Industrial facility Saw mill; wood treatment facility Spill ____ Other ____

Active ____ Inactive ✓

Topography: Not Applicable

Name of and distance to nearest surface water body: Snohomish River

Surrounding land use/nearest population: Vacant land; railway yard/Everett, Washington

Site access: Access by boat

Nearest drinking water/sanitary facilities: On boat

Nearest telephone (list number if possible): PTI cellular (206) 953-3191

List utilities located (or to be located): PTI will coordinate with Weyerhaeuser and utility location service

Site map attached: Yes

PROJECT PERSONNEL

	Name/Affiliation	Work Telephone	Home Telephone
Project manager	Lawrence McCrone	(206) 643-9803	(206) 643-0948
Field team leader	Jane Sexton	(206) 643-9803	(206) 782-1754
Site safety officer	Jane Sexton	(206) 643-9803	(206) 782-1754
PTI field personnel	Jane Sexton	(206) 643-9803	(206) 782-1754
	Sherrill Nelligan-Doran	(206) 643-9803	(206) 828-0824
Facility contact	Harold Ruppert	(206) 339-2868	
Client contact (if different)			

WORK PROPOSED

Description of proposed work: Sediment sampling with sample processing at PTI's Overlake field office (i.e., extrude cores, homogenize samples)

Proposed work dates: July 8–9, 1996

Subcontractors:

Name	Task	Contact	Telephone
ENSR Consulting and Engineering	Sampling vessel/ vibrocore	Scott Bertram	(206) 881-7700

If visual inspection, will personnel be entering or contacting potentially hazardous areas? NA

If yes, describe:

HAZARD EVALUATION

Potentially hazardous chemicals known or suspected to be onsite (include preservatives and decontamination chemicals):

Substance	Concentration	Medium	OSHA PEL	OSHA STEL	Odor Threshold	IP(eV)	Carcinogen or Other Hazard
Acetone	Decon chemical	NA	750	1000	13-100 ppm	9.69	No
Hexane	Decon chemical	NA	50	--	130 ppm	10.18	No
Arsenic	<500 ppm	Sediment	NA	NA	NA	NA	Yes
Copper	<500 ppm	Sediment	NA	NA	NA	NA	No
PAHs	<100 ppb	Sediment	NA	NA	NA	NA	Yes

Note:

--	- none established
C	- carcinogen
GW	- groundwater
IP(eV)	- ionization potential
N/A	- not applicable
NA	- not available
P	- poison
PAH	- polycyclic aromatic hydrocarbon
PCB	- polychlorinated biphenyl
PEL	- permissible exposure level
SC	- suspected carcinogen
STEL	- short-term exposure level

Potential chemical exposure routes at the site:	**Known**	**Possible**	**Unlikely**
Inhalation	✓ (decon chemicals)		✓ (sediments)
Ingestion			✓
Skin absorption		✓	
Skin contact		✓	
Eye contact		✓	

Chemical characteristics:	Known	Possible	Unlikely
Corrosive			✓
Ignitable			✓
Reactive			✓
Volatile		✓ (decon chemicals)	
Radioactive			✓
Explosive			✓
Biological agent			✓
Particulates or fibers			✓

If known or likely, describe:

Possible physical hazards present during site investigation activities:

	Yes	No	Proposed Safety Procedure
Uneven terrain/tripping	✓		Keep work area clean, exercise caution
Heat stress		✓	
Cold/hypothermia		✓	
Drowning	✓		Wear life preserver when over water
Falling objects	✓		Stay out from under sampling equipment and wear hard hat
Noise		✓	
Excavations		✓	
Scaffolding		✓	
Heavy equipment		✓	
Material handling	✓		Lift sampler and other heavy objects properly—get assistance if needed
Compressed air equipment		✓	
Confined spaces		✓	
Other: Marine activities	✓		See attached Marine Safety SOP

Note: If confined space entry is required, personnel must first obtain a confined space entry permit.

Potential physical hazards posed by proposed site activities:

Activity	Potential Hazard
Sediment sampling	Chemical contact, slips/trips, drowning

PERSONAL PROTECTIVE EQUIPMENT

Based on the hazards identified above, the following personal protective equipment will be required for the following site activities (specify both an initial level of protection and a more protective level of protection in the event conditions should change):

	Level of Protection	
	Initial	Contingency
Drilling		
Soil sampling		
Groundwater sampling		
Surface water sampling		
Sediment sampling	Mod D	NA
Site inspection		
Sample processing	Mod D	NA
Other activities (list): Decon Note: Solvent decon should be performed in open air with cross breeze. **Wear silver shield gloves.**	Mod D	C

Each level of protection will incorporate the following equipment (specify type of coveralls, boots, gloves, respiratory cartridges or other protection, safety glasses, hardhat, and hearing protection):

Level D: Work clothes (cotton coveralls or long-sleeved pants and shirt), safety glasses, hard hat

Modified D: Same as above with chemical-resistant boots, polylaminated Tyvek, nitrile gloves

Wear silver shield gloves for chemical decon.

Level C: Same as above Mod D, with addition of air purifying respirator with organic vapor cartridges

Wear silver shield gloves for chemical decon.

Level B:

NOTE: Project personnel are not permitted to deviate from the specified levels of protection without the prior approval of the site safety officer or PTI corporate health and safety officer.

SAFETY EQUIPMENT

The following safety equipment will be onsite during the proposed field activities:

Air Monitoring (Circle the items required for this project) *None required*

PID
CG/O_2 meter
H_2S meter
Detector pump and tubes
Air sampling pumps
Miniram
Radiation meter
Other:

First Aid Kit (Mandatory, list any additional items required for the site)

Oral thermometer
Bandages*
Topical antibiotic*
Aspirin*
Insect Repellant
Tweezers*
Emergency blanket
Sunscreen
CPR shield*
Gloves*
Other:

*Include in normal first aid kit.

Other (Circle the items required for this project)

Eyewash
Drinking water
Stopwatch for heart rate monitoring
Fit test supplies
Fire extinguisher (assumed to be on the vessel)
Windsock
Other:

SITE CONTROL

Describe how exclusion zones and contamination/reduction zones will be designated (attach sketch, if possible):

The deck of the vessel where operation of the vibrocore takes place will be designated as the exclusion zone. Processing of the samples will be conducted at PTI's field office where appropriate steps will be taken (i.e., laying down plastic sheeting, washing exposed surfaces, bagging waste materials) to minimize the potential for contamination.

Describe controls to be used to prevent entry by unauthorized persons:

Pre-work briefing.

AIR MONITORING

Air monitoring will be conducted when entering previously uncharacterized sites, when working in the vicinity of uncontained chemicals or spills, when opening containers and well casings, and prior to opening and entering confined spaces. Air monitoring must be conducted to identify potentially hazardous environments and determine reference or background concentrations. Air monitoring will be used to define exclusion zones. Air monitoring may also be conducted to evaluate the concentration of chemicals in samples.

The following equipment will be used to monitor air quality in the breathing zone during work activities:

Monitoring Instrument	Calibration Frequency	Parameters of Interest	Sampling Frequency
None required - chemical decon will be performed outdoors			

The following action levels have been established to determine the appropriate level of personal protection to be used during site investigation activities:

Instrument	Reading	Action[a]	Comments
NA			

[a] Examples: "upgrade to Level C" or "leave site."

DECONTAMINATION

To prevent the distribution of contaminants outside the exclusion zone or cross-contamination of samples, the following procedures will be used to decontaminate sampling equipment:

Rinse with site seawater (high power), wash sampling equipment with detergent (Alconox®) and rinse with site seawater, then acetone, then hexane, followed by final rinse with site seawater. Air dry.

To prevent the distribution of contaminants outside the exclusion zone and personal exposure to chemicals, vehicles will not be allowed inside the exclusion zone. If vehicles are required in the exclusion zone (e.g., drill rigs), the following procedures will be used to prevent contamination or decontaminate the vehicles:

Vehicles will not be in the exclusion zone.

To minimize or prevent personal exposure to hazardous materials, all personnel working in the exclusion zone and contamination reduction zones will comply with the following decontamination procedures:

Remove protective clothing, wash hands with soap and water prior to eating, drinking, or smoking.

Decontamination equipment required on site will include the following:

Brushes, Alconox®, acetone, hexane, squirt bottles, paper towels, garbage bags.

Decontamination wastewater and contaminated materials will be disposed of in the following manner:

Solvents will be collected for disposal. Other wastes are non-hazardous.

The following personal hygiene practices will be used:

- Long hair will be secured away from the face so that it does not interfere with any activities.
- All personnel leaving potentially contaminated areas will wash their hands and face prior to entering any clean areas or eating areas.
- Personnel leaving potentially contaminated areas will shower (including washing hair) and change to clean clothing as soon as possible after leaving the site.
- No person will eat, drink, or chew gum or tobacco in potentially contaminated areas. Drink containers and drinking of replacement fluids for heat stress control will be permitted only in areas that are free from contamination. Smoking is prohibited in all areas of the site because of the potential for contaminating samples and for health and safety reasons.

SPILL CONTAINMENT

Provisions must be made for spill containment at any site where bulk liquids will be handled.

Will the proposed field work include the handling of bulk liquids, oil, or chemicals (other than water)? Yes ______ No ✓

If yes, describe spill containment provisions for the site: ______________________

____

____

SHIPMENT OF RESTRICTED ARTICLES

Federal laws and international guidelines place restrictions on what materials may be shipped by passenger and cargo aircraft. In the course of this field investigation, the following items will be shipped to and from the site in the following manner:

Item	Hazardous Constituent	Quantity	Packaging	How Shipped
Samples	Not hazardous			
Solvents (name)	Acetone and hexane	< 1 qt	Glass or polyethylene bottle, protected for shipment	Private vehicle
Calibration gas (name)	NA			
Preservatives (name)	NA			
Other: ______	NA			

MEDICAL MONITORING

OSHA requires medical monitoring for personnel potentially exposed to chemical hazards in concentrations in excess of the PEL for more than 30 days per year, and for personnel who must use respiratory protection for more than 30 days per year. PTI requires medical monitoring for all employees potentially exposed to chemical hazards.

Will personnel working at this site be enrolled in a medical monitoring program? Yes ✓ No ______

HEALTH AND SAFETY TRAINING

State and federal laws establish training requirements for workers at uncontrolled hazardous waste sites (including areas where accumulations of hazardous waste create a threat to the health and safety of an individual, the environment, or both).

PTI and subcontractor personnel will be required to complete the following training requirements:

Duties	No Special Training[a]	24-hour	40-hour	80-hour	Other
PTI Personnel					
Jane Sexton			✓		Supervisor training
Sherrill Nelligan-Doran			✓		Supervisor training
Subcontractors					
Jack Libby			✓		
Al Seaton			✓		

[a] Provide explanation or justification:

EMERGENCY INFORMATION

Local Resources	Name	Telephone	Notified Prior to Work (Yes/No)?
Fire	Everett Fire	911	No
Police	Everett Police	911	No
Ambulance	Everett Fire	911	No
Hospital	General Hospital of Everett	(206) 258-5300	No
Site phone	PTI cellular	(206) 953-3191	

Directions to hospital: See attached map and directions.

Corporate Resources	Name	Work Telephone	Home Telephone
PTI health and safety officer	Greg Bawden	(206) 643-9803	(206) 788-0436
Regional health and safety officer	Same		
Medical consultant	Dr. Petrie	(206) 242-3651	

In case of serious injuries, death, or other emergency, the corporate health and safety officer must be notified immediately. To contact the corporate health and safety officer (or delegate), try calling Greg Bawden at the work and home numbers listed above. If no response, call the emergency pager (206) 996-1480. If no response, call Larry Marx at (206) 643-9803 or (206) 643-6019 or (206) 378-3252. If no response, call Chip Hogue at (206) 643-9803 or (206) 820-6114.

Other Resources	**Agency Name/Location**	**Telephone**
Local OSHA office		
State OSHA equivalent	WDLI	281-5449

DOCUMENTATION

	Attached	**In File**	**Not Applicable**
PTI site safety acknowledgment forms	X		
OSHA or equivalent state poster	X		
Site safety meeting minutes	X		
PTI accident/incident report form		X	
PTI heat stress monitoring form			X
PTI confined space entry permit			X
PTI confined space entry checklist			X
PTI air monitoring record			X
PTI air sampling record			X
PTI diving plan			X
Other:			

ATTACHMENTS

	Attached	**In File**	**Not Applicable**
Site map		X	
Work plan		X	
Material safety data sheets (acetone and hexane)	X		
Hospital route	X		
Health and safety training records		X	
Heat stress standard operating procedure			X
Confined space entry information			X
Equipment standard operating procedures (list below)			X
Other: Marine operations SOP	X		

PTI ENVIRONMENTAL SERVICES

SITE SAFETY PLAN CONSENT AGREEMENT

I have reviewed the site safety plan prepared by Lawrence McCrone, dated June 18, 1996, for the Everett site field work. I understand the purpose of the plan and I consent to adhere to its policies, procedures, and guidelines while an employee of PTI or its subcontractors.

Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date
Employee signature	Firm	Date

PTI Environmental Services

SITE SAFETY MEETING MINUTES

Site Name ______________________________ Contract No. ______________________

Meeting Location ____

Meeting Date _________ Time __________ Conducted by _____________________

Pre-field Work Orientation ___ Weekly Site Meeting ___ Other _________________

Subjects Discussed ____

____

____

____

Safety Officer Comments ____

____

____

____

Name and Signature of Participating Personnel (list company name if subcontractor)

____

____

____

____

____

____

____

____

Note: Attach additional pages if necessary. Send this form to the PTI corporate health and safety officer. Copies will be placed in the appropriate project files.