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ENVIRONMENTAL SERVICES

Draft

Baseline Sediment Assessment

Weyerhaeuser's Former Kraft Pulp Mill Facility Everett, Washington

Prepared for

Weyerhaeuser Paper Company
Everett, Washington

July 1994

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15375 SE 30th Place
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101 E. Marine View Drive
Everett, Washington 98201

PTI Contract C545-01-01

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

CSL	cleanup screening levels
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxin
PCDF	polychlorinated dibenzofuran
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PTI	PTI Environmental Services
QA/QC	quality assurance and quality control
SQS	sediment quality standards
TOC	total organic carbon
WAC	Washington Administrative Code
Weyerhaeuser	Weyerhaeuser Paper Company

EXECUTIVE SUMMARY

PTI Environmental Services, on behalf of Weyerhaeuser Paper Company, conducted a baseline sediment assessment in the vicinity of the wastewater outfalls serving the former Kraft pulp mill facility in Everett, Washington (Figure 1). The purpose of this study was to assess sediment quality in the vicinity of the facility's wastewater outfalls.

Surface (0–10 cm) sediments were sampled from 20 stations at the site, from 1 station at a local background area, and from 2 stations at Holmes Harbor on Whidbey Island (reference area) to provide a baseline characterization of onsite sediment conditions. Environmental conditions were evaluated by analyzing 1) sediment chemical and physical characteristics, including certain semivolatile organic compounds (i.e., selected acid/base/neutral compounds), polychlorinated biphenyls, polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran congeners, selected metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), total sulfides, total organic carbon, and grain-size distribution; 2) acute sediment toxicity, as determined by testing amphipod mortality and bivalve larvae abnormality/mortality; and 3) chronic sediment toxicity, as determined by testing for changes in juvenile polychaete biomass.

The quality of the sediment was evaluated by comparison of the chemical concentrations and toxicity test results with applicable criteria of the Washington State Sediment Management Standards. Overall, this baseline sediment assessment found surface sediments in the vicinity of the Weyerhaeuser wastewater outfalls to have low concentrations of most chemical contaminants. The only chemicals found to exceed the sediment quality standards (SQS) criteria of the Washington State Sediment Management Standards in the sediments at any of the stations in the vicinity of these outfalls were total PCBs and 4-methylphenol, each at a single station. The only chemical found to exceed the cleanup

screening levels (CSL) criteria in the vicinity of these outfalls was 4-methylphenol at a single station.

Similarly, surface sediments were found to be generally nontoxic in the three different sediment toxicity tests. Among the 36 toxicity tests completed (i.e., three toxicity tests at each of twelve stations in the vicinity of these outfalls), only five exceeded the SQS biological effects criteria and only one of these also exceeded the CSL biological effects criteria. There are indications that at least some of the exceedances of SQS and CSL biological effects criteria may be attributable to factors other than chemical contamination (i.e., wood debris, fine grain size, high TOC content, or high total sulfides concentration).

The sediment chemistry and biological effects data were evaluated under the provisions of the Sediment Source Control Standards (Part IV) of the Washington State Sediment Management Standards (Chapter 173-204 WAC). On the basis of that evaluation, there does not appear to be a need for authorization of a sediment impact zone for any of the four permitted outfalls at the Weyerhaeuser facility.

The sediment chemistry and biological effects data were also evaluated under the provisions of the Sediment Cleanup Standards (Part V) of the Washington State Sediment Management Standards (Chapter 173-204 WAC). On the basis of that evaluation, there do not appear to be any "station clusters of potential concern" in the vicinity of any of these outfalls; therefore, there should be no need for a more detailed hazard assessment.

In conclusion, overall sediment quality in the vicinity of the Weyerhaeuser facility's outfalls appears to be good, and no further sediment-related action should be required by Ecology.

1. INTRODUCTION

This report summarizes the methods, results, and conclusions of a baseline sediment assessment conducted in March–April 1994 at Weyerhaeuser Paper Company's (Weyerhaeuser) facility in Everett, Washington. The former Weyerhaeuser Kraft pulp mill facility is located near the mouth of the Snohomish River, south of Smith Island and east of Preston Point (Figure 1).

The sediment study and this report were completed by PTI Environmental Services (PTI), on behalf of Weyerhaeuser. The purpose of this study was to assess sediment quality in the vicinity of the facility's wastewater outfalls. Environmental conditions were evaluated by analyzing 1) sediment chemical and physical characteristics; 2) acute sediment toxicity, as determined by testing amphipod mortality and bivalve larvae abnormality/mortality; and 3) chronic sediment toxicity, as determined by testing for changes in juvenile polychaete biomass. 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), and are in accordance with the procedures described in the *Sediment Source Control Standards User Manual* (Ecology 1993b). All sampling and analytical testing was conducted in accordance with the *Baseline Sediment Sampling and Analysis Plan* (PTI 1994). However, as discussed in Section 2.3, modifications to the toxicity testing protocols were necessitated by the occurrence of low salinity (<25 ppt) interstitial water in many of the sediment samples. These modifications were verbally approved by the Washington Department of Ecology (Ecology) prior to conducting the sediment toxicity tests (McCrone 1994, pers. comm.).

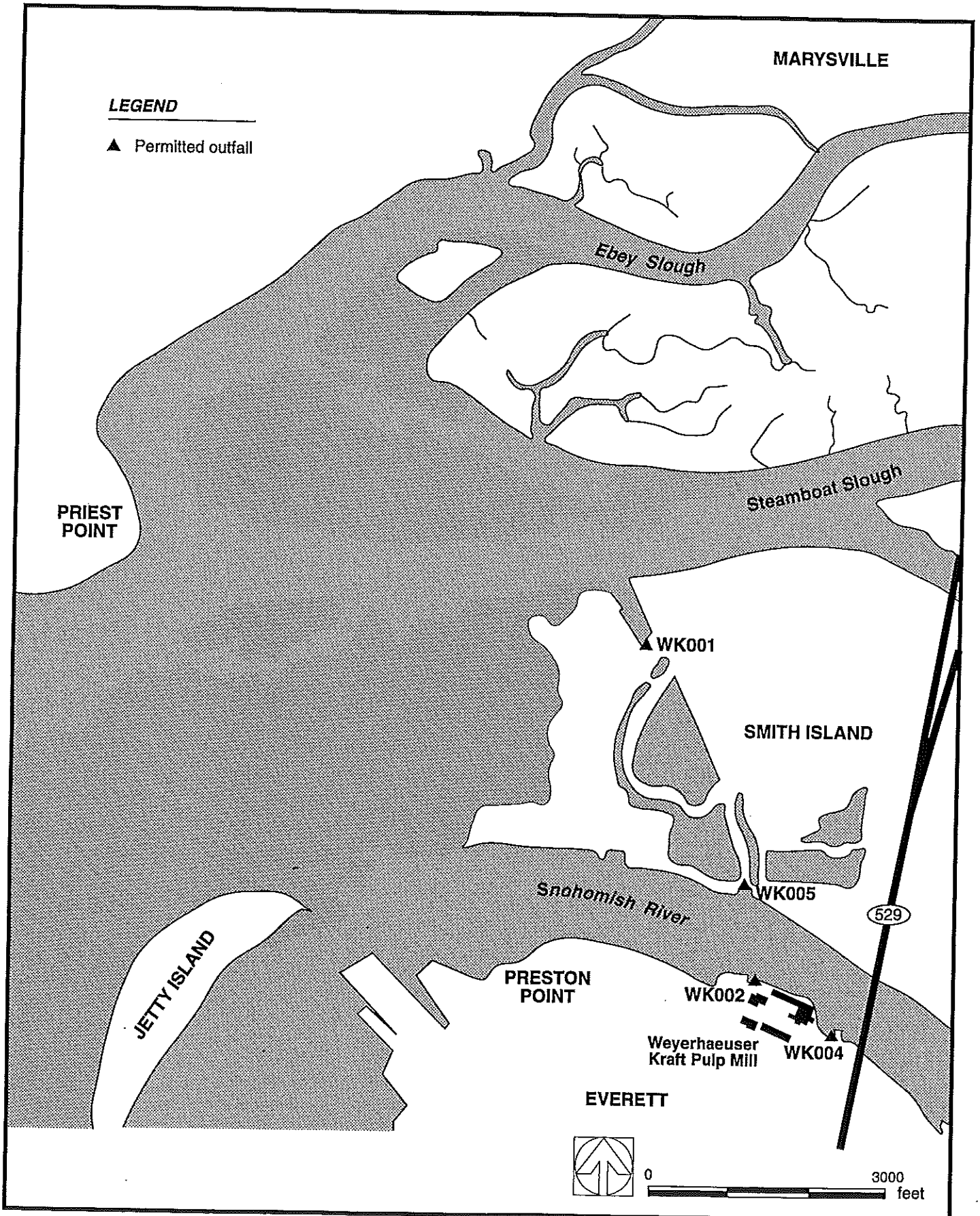

Figure 1. General vicinity of the former Weyerhaeuser Kraft pulp mill in Everett, Washington.

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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. From 1953 through 1992, Weyerhaeuser operated a Kraft pulp mill in north Everett. Manufacturing of paper products was the primary activity at the mill. Wastewater discharges from the mill were permitted under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA 000300-0). While the mill was operational, treated process wastewater from the Kraft pulp mill was discharged from Weyerhaeuser's Smith Island treatment ponds into Steamboat Slough through Outfall WK001 (Figure 1). Noncontact cooling water and storm water runoff were discharged from Outfall WK002. Backwash from the mill's water filtration system was discharged from Outfall WK004. Surface runoff from the south side of Smith Island was discharged through Outfall WK005.

Currently, Weyerhaeuser owns approximately 300 acres of industrial land in north Everett. Weyerhaeuser ceased operation of the Kraft pulp mill on March 30, 1992; however, the NPDES permit is still in force. Since closure of the pulp mill, the only discharge from Outfall WK001 has been of excess storm water that accumulated in the Smith Island treatment ponds. Storm water continues to be discharged from Outfalls WK002, WK004, and WK005. The mill's water filtration system still periodically discharges river water from Outfall WK004. Weyerhaeuser's only operational facility in the Everett area is the log sort yard on Smith Island.

Administrative Order No. 91-AQI113, issued by Ecology on February 14, 1992, required Weyerhaeuser to prepare a "sediment baseline study plan" to determine whether there is any "significant accumulation of contaminated sediment near the permittee's outfall." Although operations at the mill terminated in 1992, the Order, which was issued concurrently and in association with the most recent NPDES permit, remains in force.

1.2 REPORT OVERVIEW

Methods for collecting sediment samples; performing chemical, physical, and biological analyses of the sediment samples; and evaluating the resulting data are described in Section 2. The results of chemical, physical, and biological analyses of the sediment samples are presented in Section 3. Interpretation of the results with regard to potential actions by Ecology is presented in Section 4. The conclusions of the baseline sediment assessment are discussed in Section 5. References are provided in Section 6, followed by appendices with supporting documentation for the sampling and analysis activities.

2. METHODS

This section summarizes the methods for collecting sediment samples; performing chemical, physical, and biological analyses of the sediment samples; and evaluating the resulting data.

2.1 SEDIMENT SAMPLE COLLECTION

Sediment samples were collected at 23 stations (Figure 2) during the period March 28 through April 1, 1994, from the research vessel *Kittiwake*. Station locations were recorded using a standard global positioning system (GPS), radar ranges, and visual correlation to fixed landmarks on shore because the differential GPS unit did not function properly. Information on the depths and geographic locations of all stations and transects is presented in Appendix A. All samples were collected in accordance with standard techniques consistent with PSEP protocols (PSEP 1986a), following the procedures described in PTI (1994).

Sediment for chemical, physical, and biological analyses was collected using a 0.06-m^2 box corer deployed from an A-frame. Sediment samples were collected from the upper 0–10 cm of the sediment surface. If the box corer failed to retrieve a sediment core of at least 10 cm, the sample was rejected and another cast was made at that station. The water overlying the sediment in the box corer was removed by siphoning. The sediment was then inspected for texture, color, odor, and evidence of contamination (e.g., color or sheen). The top 10 cm of sediment was removed using stainless-steel utensils and placed in a stainless-steel bowl. The sediment sample was then homogenized by stirring with a stainless-steel spoon until the color and texture were visually uniform.

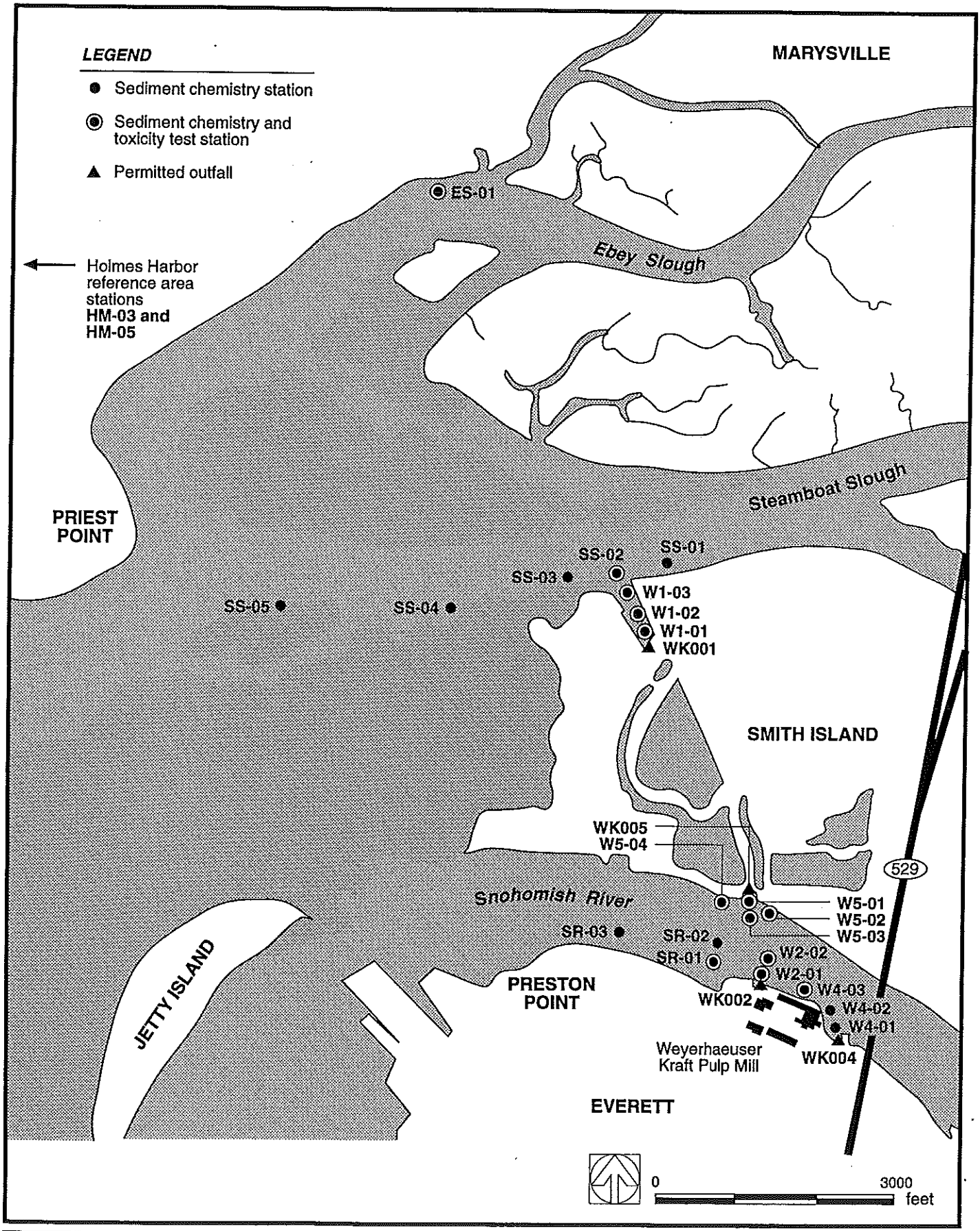

Figure 2. Sediment sampling stations.

Subsamples from each sediment sample were placed in precleaned glass jars with Teflon®-lined lids and stored at 4°C until laboratory analysis. Chain-of-custody records are provided in Appendix B. To prevent cross-station contamination, the box corer and all subsampling utensils were rinsed with seawater, scrubbed with Alconox® detergent, and then rinsed sequentially with seawater, acetone, and hexane at the start of sampling at each station.

2.2 CHEMICAL AND PHYSICAL ANALYSES

All sediment samples were analyzed by the Weyerhaeuser Chemical Analytical Laboratories for selected chemicals and for grain-size distribution, as specified in PTI (1994). A quality assurance review was performed on the analytical data in accordance with project data quality objectives that are also specified in PTI (1994). All of the analytical results were judged to be suitable as received from the laboratory. As a result of the quality assurance review, the following data were qualified:

- Benzoic acid was reported as detected in six sediment samples at concentrations less than 5 times the concentration detected in the method blank. Therefore, in accordance with actions specified by EPA (U.S. EPA 1990a), the results reported for benzoic acid in the six samples were determined to have been reported as false positives and the results were restated as undetected. This qualification of the data does not affect the conclusions of this report because the detection limits for benzoic acid were well below the applicable criteria of the Washington State Sediment Management Standards.

- Selected metals data may be negatively or positively biased. Exceedances of specific quality control criteria were identified for matrix spike recoveries, duplicate sample analyses, and inductively coupled plasma spectroscopy serial dilutions. Because of these exceedances, a greater degree of

uncertainty may be attributed to the qualified data. The laboratory reported a total of 575 metals values (i.e., 23 metals for each of 25 samples). Although no data were rejected, 101 of the 575 metals values were qualified as estimated. This qualification of the data does not affect the conclusions of this report because the only metal so qualified for which there are applicable criteria in the Washington State Sediment Management Standards was arsenic, and the estimated concentrations for arsenic were well below those criteria.

2.2.1 Metals

Sediment samples intended for metals analyses were 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. Selected metals (see PTI 1994, Table A-1) were analyzed by appropriate EPA SW-846 methods (U.S. EPA 1986), as modified by PSEP (1989b). Analyses were conducted using inductively coupled plasma spectroscopy and graphite furnace atomic absorption spectroscopy. Mercury analyses of sediment and water were conducted according to EPA methods (U.S. EPA 1986) using cold vapor atomic absorption spectroscopy. Lead was determined by graphite furnace atomic absorption spectroscopy to achieve the target detection limits.

2.2.2 Semivolatile Organic Compounds

Certain semivolatile organic compounds (i.e., selected acid/base/neutral compounds) (see PTI 1994, Tables A-1 and A-6) were analyzed using gas chromatography/mass spectrometry in accordance with procedures specified by EPA SW-846 Method 8270 (U.S. EPA 1986), 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 (e.g., 1–2 ng on-column). These modifications were used to attain the project detection limits (see PTI 1994, Table A-3). Also, all samples were subjected to gel permeation chromatography cleanup procedures using EPA SW-846 Method 3640 (U.S. EPA 1986). Gel permeation chromatography was used to reduce interferences that may inhibit attaining the project detection limits specified in PTI (1994, Table A-3).

2.2.3 Polychlorinated Biphenyls

Total polychlorinated biphenyls (PCBs) (see PTI 1994, Table A-1) were 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 concentration to a smaller final extract volume (e.g., 0.5 mL) and demonstration of instrument sensitivity using low-level standards. These modifications were used to attain the project detection limits (see PTI 1994, Table A-3). The sample extracts were subjected to sulfur cleanup (EPA SW-846 Method 3660), as needed, to reduce potential interferences that would inhibit attainment of the project detection limits specified in PTI (1994, Table A-3).

2.2.4 Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans

Polychlorinated dibenzo-*p*-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) congeners (see PTI 1994, Table A-7) were analyzed using high resolution gas chromatography/high resolution mass spectrometry procedures specified by EPA Method 1613 (U.S. EPA 1990b). 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 were used to correct the analytical results for losses of target compound concentrations that occurred during sample processing (e.g., extraction and cleanup procedures). Sample extract cleanup procedures specified

in EPA Method 1613 (U.S. EPA 1990b) were used to attain the project detection limits and to reduce potential interferences.

2.2.5 Total Organic Carbon

The total organic carbon (TOC) content of the sediment samples was measured using a method approved for use 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 TOC using infrared detection.

2.2.6 Total Sulfides

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

2.2.7 Grain-Size Distribution

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

2.3 BIOLOGICAL ANALYSES

The marine sediment quality standards of the Washington State Sediment Management Standards (Chapter 173-204 Washington Administrative Code [WAC]) nominally apply only to sediments with interstitial water salinities $\geq$25 ppt. When the sampling and

analysis plan (PTI 1994) was prepared for this study, it was expected that there was a high likelihood that at least some of the stations (especially those near the mouth of the Snohomish River) would have sediment interstitial water salinities <25 ppt. The toxicity tests normally required by the Sediment Management Standards are intended for use with marine sediments. Because of the need to assess biological effects in the lower salinity environment near the former Weyerhaeuser Kraft pulp mill, it was necessary to make modifications to the standard toxicity tests. These modifications constitute "alternate technologies" under the Sediment Management Standards, which may be allowed by Ecology on a site-specific basis. Ecology gave verbal approval to the use of these "alternate technologies" for this study prior to conducting the toxicity tests (McCrone 1994, pers. comm.).

The following sediment toxicity tests were conducted for this study by Northwestern Aquatic Sciences:

- Amphipod mortality using *Eohaustorius estuarius*
- Bivalve larvae abnormality/mortality using *Mytilus galloprovincialis*
- Juvenile polychaete biomass using *Neanthes* sp.

The approved modifications to these tests are described below.

A quality assurance review was performed on the toxicity test results generated during this study. The review was conducted in accordance with the project data quality objectives specified in PTI (1994). All of the results were judged to be acceptable as received from the laboratory. One of the five replicate results for the seawater control tested for bivalve larvae abnormality/mortality was excluded, however, from the final data set used in this report. The survival in this one replicate was greater than the estimated initial stocking density.

2.3.1 Amphipod Toxicity Test

The amphipod toxicity test was conducted according to the PSEP (1991) protocols. This acute effects test measures adult amphipod mortality and failure to rebury in sediment after being exposed for 10 days to test sediment.

The amphipod *Rhepoxynius abronius*, which is normally used in biological testing of marine sediments, is not appropriate for use with sediments having low interstitial water salinities. It was proposed that if any of the stations in this study had interstitial salinities <25 ppt, then the euryhaline amphipod *Eohaustorius estuarius* would be the amphipod species used for all stations to enable valid comparisons among stations.

While the PSEP (1991) protocols indicate that the salinity of the overlying water in the toxicity tests using *E. estuarius* should be matched to the interstitial water salinity of the sediment sample, it was considered to be more appropriate to use the same interstitial water salinity for all sediments to be analyzed in this study to facilitate comparisons among stations. There are several reasons why this modification was considered to be more appropriate. First, the environment from which most of these sediment samples were collected represents a salt-wedge estuary. As such, the salinity of the water overlying the bottom is highly variable, depending on tidal stage and the amount of river discharge. At a given location, the salinity of water near the bottom may vary from nearly freshwater to nearly saltwater. The amphipods in the toxicity test are not just exposed to interstitial water, but to the overlying water as well. *E. estuarius* is extremely tolerant of wide variations in salinity, and it is unlikely to be adversely affected by salinity variations. The sediment samples submitted for toxicity testing were found to have interstitial water salinities ranging from 5.5 to 30 ppt, with a mean of 15.9 ppt. Ecology therefore approved conducting the amphipod toxicity tests with overlying water having the same salinity as the mean interstitial water salinity (15.9 ppt), regardless of the interstitial water salinity of the individual samples (McCrone 1994, pers. comm.).

Adult amphipods were exposed to a 2-cm layer of bedded test sediment in a 1-L chamber filled with clean seawater diluted to a salinity of 15.9 ppt. Five replicate analyses were conducted for each sample. After the 10-day exposure period, the surviving amphipods in each test chamber were sieved from the sediment and counted. Percent mortality was determined relative to the total of 20 individuals added to each chamber at the beginning of the test. The survivors were then exposed to clean control sediment, and the number that failed to rebury was determined. Percent nonreburial was determined relative to the number of survivors in each test chamber. Quality assurance and quality control (QA/QC) procedures included the use of positive controls (i.e., cadmium chloride), negative controls (i.e., sediment from Yaquina Bay, Oregon), and measurements of water quality conditions (i.e., temperature, salinity, pH, and dissolved oxygen). Biological effects criteria for evaluating test results (WAC 173–204-320 and 173-204-520; Table 1) are based on mortality results.

2.3.2 *Bivalve Larvae Toxicity Test*

The bivalve larvae toxicity test was conducted according to the PSEP (1991) protocols. This acute effects test measures developmental abnormalities and mortality in bivalve larvae exposed for 48 hours to test sediment.

The PSEP (1991) protocols indicate that the bivalve larvae test is not recommended for sediments having interstitial water salinities <10 ppt. However, the protocols require the use of 20 g (wet weight) of sediment and 1 L of seawater having a salinity of 28 $\pm$ 1 ppt. The protocols further require that the sediments be vigorously shaken with the water and then allowed to settle prior to introduction of the larvae. Assuming that the mass of interstitial water is approximately half (or 10 g) of the total mass of the sediment (20 g), and that it is being mixed with a mass of seawater roughly equal to 1,000 g, it is apparent that the final interstitial water salinity (after settling) cannot be much different from the salinity of the seawater, even if the original sediment interstitial water salinity

TABLE 1. BIOLOGICAL EFFECTS CRITERIA FOR PUGET SOUND MARINE SEDIMENTS

Biological Test	Sediment Quality Standards[a]	Cleanup Screening Levels[b]
Amphipod	The test sediment has a significantly higher (*t*-test, $P \leq 0.05$) mean mortality than the reference sediment, and the test sediment mean mortality exceeds 25 percent, on an absolute basis	The test sediment has a significantly higher (*t*-test, $P \leq 0.05$) mean mortality than the reference sediment, and the test sediment mean mortality is more than 30 percent greater, on an absolute basis, than the reference sediment mean mortality
Larval	The test sediment has a mean survivorship of normal larvae that is significantly less (*t*-test, $P \leq 0.05$) than the mean normal survivorship in the reference sediment, and the combined abnormality and mortality in the test sediment is more than 15 percent greater, on an absolute basis, than the reference sediment	The test sediment has a mean survivorship of normal larvae that is significantly less (*t*-test, $P \leq 0.05$) than the mean normal survivorship in the reference sediment, and the combined abnormality and mortality in the test sediment is more than 30 percent greater, on an absolute basis, than that in the reference sediment
Benthic infauna	The test sediment has less than 50 percent of the reference area sediment's mean abundance of any one of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundance is significantly different (*t*-test, $P \leq 0.05$) from the reference sediment abundance	The test sediment has less than 50 percent of the reference area sediment's mean abundance of any one of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundance is significantly different (*t*-test, $P \leq 0.05$) from the reference sediment abundances
Juvenile polychaete	The mean biomass of polychaetes in the test sediment is less than 70 percent of the mean biomass of the polychaetes in the reference sediment, and the test sediment biomass is significantly different (*t*-test, $P \leq 0.05$) from the reference sediment biomass	The mean biomass of polychaetes in the test sediment is less than 50 percent of the mean biomass of the polychaetes in the reference sediment, and the test sediment biomass is significantly different (*t*-test, $P \leq 0.05$) from the reference sediment biomass
Microtox®	The mean light output of the highest concentration of the test sediment is less than 80 percent of the mean light output of the reference sediment, and the two means are significantly different (*t*-test, $P \leq 0.05$)	Not applicable

Source: Ecology (1993b).

[a] The sediment quality standards are exceeded if one test fails the listed criteria [WAC 173-204-320(3)].

[b] The cleanup screening level is exceeded if one test fails the listed cleanup screening level criteria [WAC 173-204-520(3)] or if two tests fail the sediment quality standards criteria [WAC 173-204-320(3)].

was 0 ppt. Therefore, it was determined that the use of sediments of low interstitial water salinity should not present any problems in this toxicity test.

The test species used in the present study was the mussel *Mytilus galloprovincialis* (northwest specimens of this mussel species were formerly referred to as *M. edulis*, but they are now considered to belong to the species *M. galloprovincialis*). Adult mussels were obtained by the laboratory from Carlsbad Aquafarms. Each 1-L test chamber contained 20 g of bedded test sediment and was filled with clean seawater. After the sediment was added to each chamber, the sediments were suspended by vigorous shaking for 10 seconds and the suspended sediments were allowed to settle for 4 hours prior to the addition of larvae. Adult mussels were spawned in the laboratory after appropriate conditioning. For each toxicity test replicate, 20,000–40,000 developing embryos from a pooled sample were added to a test chamber within 2 hours of fertilization. Five replicate analyses were conducted for each sample. After the 48-hour exposure period, the seawater in each chamber was decanted and homogenized. A 10-mL subsample was then collected by pipette and fixed with a 5-percent solution of buffered formalin. Preserved samples (equal in volume to those containing 300–500 larvae in controls) were examined. Normal and abnormal larvae were enumerated to determine percent survival and percent abnormality. A minimum sample size of 20 living larvae in each of the five replicate test chambers for test sediment and reference area sediment and 100 larvae in each replicate chamber for the seawater control was scored for abnormalities. An abnormal larvae was defined as one that failed to develop into the fully shelled, hinged, D-shaped prodissoconch I stage. Percent mortality was determined separately relative to the number of larvae that survived a 48-hour exposure to clean seawater. QA/QC procedures included the use of positive controls (i.e., copper sulfate), negative controls (i.e., sediment from Yaquina Bay, Oregon), and measurements of water quality conditions (i.e., temperature, salinity, pH, and dissolved oxygen). A combined endpoint based on percent abnormality and percent mortality was also estimated and used for comparison with biological effects criteria (Table 1).

2.3.3 *Juvenile Polychaete Toxicity Test*

The juvenile polychaete toxicity test was conducted in accordance with the PSEP (1991) protocols and Johns et al. (1990). This chronic effects test measures mortality and biomass in juvenile polychaetes exposed for 20 days to test sediment. The test species used in the present study was *Neanthes* sp.

The PSEP (1991) protocol for the juvenile polychaete toxicity test states that modification of the protocol may be required for sediments having interstitial water salinities <20 ppt. This issue was discussed with Dr. Mike Johns of EVS Consultants, who developed the protocol, and he indicated that the organisms would be stressed osmotically and may even die at interstitial water salinities <20 ppt (Johns 1994, pers. comm.). He did indicate, however, that the Puget Sound Dredged Disposal Analysis (PSDDA) Program allows for the adjustment of interstitial salinity in this toxicity test for this reason. Mr. Dave Kendall at the U.S. Army Corps of Engineers, Seattle District, indicated that PSDDA recognizes the need for adjusting the salinity of interstitial water for the juvenile polychaete test for sediments with interstitial water salinities <20 ppt (Kendall 1994, pers. comm.). He suggested using the procedure outlined in the PSEP (1991) protocols for adjusting interstitial salinity for the *R. abronius* toxicity test. Therefore, it was proposed and approved by Ecology to use that procedure for the juvenile polychaete test in the event that individual sediment samples were found to have interstitial water salinities <20 ppt. The adjustment would not be made on sediments with interstitial water salinities ≥20 ppt. Without this adjustment, the juvenile polychaete toxicity test should not be applied to sediments having interstitial water salinities <20 ppt because it would not be possible to separate effects attributable to osmotic stress from effects attributable to chemicals in the sediments.

For each biomass test replicate, five juvenile polychaetes of relatively uniform size were exposed to 150 g of test sediment in a 1-L chamber filled with clean seawater, diluted as necessary for those sediment samples with interstitial salinities <20 ppt. Five replicate test chambers were used for each sample. Before testing, three random

subsamples of polychaetes (five individuals per subsample) were dried at 50°C for 24 hours and weighed to the nearest 0.1 mg to provide an estimate of initial biomass. Following placement of the polychaetes in the exposure chamber, initial observations (i.e., 1 hour) of burrowing activity were made. Every second day, approximately 40 mg of food (i.e., TetraMarin®) was added to each test chamber. Every third day, 33 percent of the water volume in each chamber was exchanged with fresh seawater to prevent water quality from deteriorating. After the 20-day exposure period, the survivors in each test chamber were counted. Percent mortality was determined relative to the total of five individuals added to each chamber at the start of the test. All survivors were dried at 50°C for 24 hours and weighed (as a group) to the nearest 0.1 mg to determine the final biomass for each replicate. The percent decrease in average individual biomass relative to the control was then determined by subtracting the replicate-specific estimate of final biomass from the estimate of final biomass in the control, dividing by the control biomass estimate, and multiplying by 100. QA/QC procedures included the use of positive controls (i.e., cadmium chloride), negative controls (i.e., sediment from Yaquina Bay, Oregon), and measurements of water quality conditions (i.e., temperature, salinity, pH, and dissolved oxygen). Biological effects criteria (Table 1) for evaluating test results are based on biomass results.

2.4 DATA EVALUATION

Sediment chemistry results for samples from the 23 stations were evaluated by comparisons with the sediment quality standards (SQS) and cleanup screening levels (CSL) in the Washington State Sediment Management Standards (WAC 173–204-320 and 173-204-520, respectively). The SQS include chemical concentration criteria that define the degree of sediment quality that is expected to cause no adverse effects to biological resources of Puget Sound marine sediments. The CSL include chemical concentration criteria that define the upper limit of sediment quality that can be expected to cause only minor adverse effects to biological resources. The SQS and CSL criteria are typically applied

to surface or near-surface sediments because they represent the biologically active zone where potential chemical effects are of greatest concern.

The results of the toxicity tests for the various sampling stations were compared to the reference area results, and any areas of elevated or statistically significant toxicity (relative to reference area results) were identified. For each toxicity test endpoint measured, the mean response for a given sample was compared with the mean response for the reference area sample using a *t*-test and a one-tailed probability level of $\alpha=0.05$. A one-tailed test was used because only statistically significant adverse effects (e.g., increased mortality relative to reference results) are considered relevant. Results for each station that were significantly different from the reference station results were compared with SQS and CSL biological effects criteria to determine whether effects at individual stations exceeded those criteria (i.e., to be considered an exceedance of either the SQS or CSL biological effects criteria, the toxicity test response for a given sample must not only be significantly different from that of the reference station sample, but also exceed established absolute values or differences from the reference station response; see Table 1).

3. RESULTS

This section presents the results of the chemical, physical, and biological analyses of the sediment samples collected during the baseline sediment assessment in the vicinity of the Weyerhaeuser site in Everett. Table 2 summarizes the sediment samples collected during the study. Interpretation of the results with regard to the Washington State Sediment Management Standards and potential actions by Ecology is presented in Section 4.

3.1 SEDIMENT CHEMISTRY

Sediment chemistry results (dry-weight basis) are reported in Tables 3, 4, and 5. Table 3 includes results for those metals and organic compounds for which there are SQS and CSL criteria in the Washington State Sediment Management Standards. The results for other metals and semivolatile organic compounds can be found in the laboratory data reports (Appendix C). Table 4 includes results for PCDDs and PCDFs. Table 5 includes results for grain size, TOC, total sulfides, and interstitial salinity.

Table 6 is intended to facilitate direct comparisons of the results with the SQS and CSL criteria of the Washington State Sediment Management Standards, which are reported in the right-hand columns on each page of the table. The SQS and CSL criteria for certain organic compounds (i.e., non-ionizable semivolatile organic compounds and PCBs) are expressed on a TOC-normalized basis. Consequently, Table 6 includes the dry-weight normalized concentrations of metals and ionizable semivolatile organic compounds (e.g., phenol) and the TOC-normalized concentrations of the non-ionizable semivolatile organic compounds and PCBs. The TOC-normalization is conducted by dividing the dry-weight normalized concentration (i.e., mg/kg dry weight) by the decimal fraction corresponding

TABLE 2. SUMMARY OF SAMPLES COLLECTED D
BASELINE SEDIMENT ASSESSMENT SAMPLIN

For ease of reading, place Tables at end of Results prior to discussion

Station Number	Sample Number	Sediment Chemistry	Amphipod Test	Bival Tes		
Onsite Stations						
W1-01	WE013	X	X	X	X	X
W1-02	WE014	X	X	X	X	X
W1-03	WE015	X	X	X	X	X
SS-01	WE016	X				X
SS-02	WE017	X	X	X	X	X
SS-03	WE018	X				X
SS-04	WE019	X				X
SS-05	WE020	X				X
W4-01	WE001	X				X
W4-02	WE002	X				X
	WE025[a]	X				X
W4-03	WE003	X	X	X	X	X
W2-01	WE004	X	X	X	X	X
W2-02	WE005	X	X	X	X	X
SR-01	WE007	X	X	X	X	X
SR-02	WE006	X				X
SR-03	WE008	X				X
W5-01	WE011	X	X	X	X	X
W5-02	WE010	X	X	X	X	X
W5-03	WE009	X	X	X	X	X
W5-04	WE012	X	X	X	X	X
Local Background						
ES-01	WE021	X	X	X	X	X
Reference Area						
HM-03	WE022	X	X	X	X	X
HM-05	WE023	X	X	X	X	X

[a] Field duplicate.

TABLE 3. SEDIMENT CONCENTRATIONS (DRY–WEIGHT BASIS) OF SELECTED METALS AND ORGANIC COMPOUNDS

Chemical	Station Number / Sample Number	W1–01 WE013	W1–02 WE014	W1–03 WE015	SS–01 WE016	SS–02 WE017	SS–03 WE018	SS–04 WE019	SS–05 WE020	W4–01 WE001
Metals (mg/kg dry weight)										
Arsenic		11.2 *J*	9.7	15.9	5.2	5.2	6	5	5	11
Cadmium		0.56 *U*	0.46 *U*	0.6 *U*	0.27 *U*	0.29 *U*	0.29 *U*	0.37 *U*	0.39 *U*	0.47 *U*
Chromium		64.7	54.1	65.2	32	28.6	28.8	38.7	26.5	51.5
Copper		53.1	49	60.9	22	20.9	19.3	26.2	16.5	48.6
Lead		11.1	11	14	4.6	4.5	4.6	6.4	3.4	11.2
Mercury		0.12 *U*	0.39	0.16	0.13	0.06 *U*	0.1	0.06 *U*	0.06 *U*	0.14
Silver		0.66	0.44 *U*	0.57 *U*	0.26 *U*	0.28 *U*	0.28 *U*	0.36 *U*	0.38 *U*	0.45 *U*
Zinc		88.2	79.2	95.1	48.6	44.6	51	55.2	42.9	78.1
Nonionizable Organic Compounds (mg/kg dry weight) [a]										
Aromatic Hydrocarbons										
Total LPAH [b]		300	205	232	126	126	126	128	108	198
Naphthalene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Acenaphthylene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Acenaphthene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Fluorene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Phenanthrene		110	30 *J*	27 *J*	21 *U*	21 *U*	21 *U*	13 *J*	18 *U*	37
Anthracene		30 *J*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	29 *J*
2–Methylnaphthalene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Total HPAH [c]		986	516	495	210	185	203	194	180	605
Fluoranthene		220	110	100	21 *U*	9 *J*	21 *U*	27	18 *U*	110
Pyrene		200	58	56	21 *U*	21 *U*	21 *U*	20 *J*	18 *U*	110
Benzo[a]anthracene		76	41	27 *J*	21 *U*	21 *U*	21 *U*	10 *J*	18 *U*	55
Chrysene		170	91	57	21 *U*	21 *U*	21 *U*	16 *J*	18 *U*	91
Total benzofluoranthenes[d]		178	76 *J*	91 *U*	42 *U*	42 *U*	35 *UJ*	33 *UJ*	36 *U*	116 *J*
Benzo[a]pyrene		54	35 *U*	41 *U*	21 *U*	8 *J*	21 *U*	19 *J*	18 *U*	40
Indeno[1,2,3–cd]pyrene		24 *J*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	17 *J*
Dibenz[a,h]anthracene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Benzo[ghi]perylene		24 *J*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Chlorinated Benzenes										
1,2–Dichlorobenzene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
1,4–Dichlorobenzene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
1,2,4–Trichlorobenzene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Hexachlorobenzene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*

TABLE 3. (cont.)

Chemical	Station Number / Sample Number	W1–01 WE013	W1–02 WE014	W1–03 WE015	SS–01 WE016	SS–02 WE017	SS–03 WE018	SS–04 WE019	SS–05 WE020	W4–01 WE001
Phthalate Esters										
Dimethyl phthalate		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Diethyl phthalate		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Di–*n*–butyl phthalate		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Butyl benzyl phthalate		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
bis[2–ethylhexyl]phthalate		62	35 *U*	41 *U*	27	16 *J*	21 *U*	18 *J*	9 *J*	120
Di–*n*–octyl phthalate		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Miscellaneous										
Dibenzofuran		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Hexachlorobutadiene		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
N–Nitrosodiphenylamine		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Total PCBs		13.5 *U*	10.4 *U*	18.9	6.7	6.3	7.0	8.4	6.2 *U*	16.1
Ionizable Organic Compounds (µg/kg dry weight)										
Phenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
2–Methylphenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
4–Methylphenol		40 *U*	35 *U*	23 *J*	21 *U*	21 *U*	21 *U*	15 *J*	18 *U*	20 *J*
2,4–Dimethylphenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Pentachlorophenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Benzyl alcohol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*
Benzoic acid		40 *U*	28 *J*	37 *J*	21 *U*	21 *U*	10 *J*	17 *J*	10 *J*	68 *U*

TABLE 3. (cont.)

Chemical	Station Number / Sample Number	W4–02 WE002	W4–02 WE025	W4–03 WE003	W2–01 WE004	W2–02 WE005	SR–01 WE007	SR–02 WE006	SR–03 WE008
Metals (mg/kg dry weight)									
Arsenic		9.9	11.8	4.4	7.8	5.6	8.3	6.5	10.2
Cadmium		0.37 *U*	0.38 *U*	0.3 *U*	0.52 *U*	0.44 *U*	0.44 *U*	0.44 *U*	0.56 *U*
Chromium		50.4	43.4	30.9	40	29.6	34	28	51.4
Copper		42.4	38.3	19.5	34.7	26.8	27.7	21.6	47.1
Lead		10.7	8.3	6.4	9.9	7.5	11.6	6.3	11.4
Mercury		0.16	0.09	0.058	0.069	0.05 *U*	0.06 *U*	0.06 *U*	0.11
Silver		0.36 *U*	0.37 *U*	0.32	0.5 *U*	0.42 *U*	0.43 *U*	0.42 *U*	0.53 *U*
Zinc		77.5	66.5	45.9	68.5	53	55.7	47.3	85.5
Nonionizable Organic Compounds (mg/kg dry weight) [a,b]									
Aromatic Hydrocarbons									
Total LPAH [c]		161	147	114	290	104	126	220	222
Naphthalene		28 *U*	25 *U*	21 *U*	23 *J*	9 *J*	11 *J*	16 *J*	21 *J*
Acenaphthylene		28 *U*	25 *U*	21 *U*	14 *J*	21 *U*	22 *U*	22 *U*	30 *U*
Acenaphthene		28 *U*	25 *U*	21 *U*	28	21 *U*	22 *U*	10 *J*	16 *J*
Fluorene		28 *U*	25 *U*	21 *U*	23 *J*	21 *U*	22 *U*	20 *J*	24 *J*
Phenanthrene		33	31	21	150	11 *J*	27	57	70
Anthracene		16 *J*	16 *J*	9 *J*	52	21 *U*	22 *U*	95	61
2–Methylnaphthalene		28 *U*	25 *U*	21 *U*	11 *J*	21 *U*	22 *U*	12 *J*	30 *U*
Total HPAH [d]		537	459	250	2555	517	347	600	1005
Fluoranthene		110	88	46	670	87	83	120	320
Pyrene		100	83	48	460	50	58	120	170
Benzo[a]anthracene		47	41	20 *J*	200	46	27	79	95
Chrysene		84	76	26	440	180	47	91	160
Total benzofluoranthenes[d]		84	82	32 *J*	440	85	48 *J*	83 *J*	140 *U*
Benzo[a]pyrene		28	34	15 *J*	150	25	18 *J*	41	30 *U*
Indeno[1,2,3–cd]pyrene		28 *U*	17 *J*	21 *U*	95	14 *J*	22 *U*	22 *U*	30 *U*
Dibenz[a,h]anthracene		28 *U*	13 *J*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Benzo[ghi]perylene		28 *U*	25 *U*	21 *U*	75	9 *J*	22 *U*	22 *U*	30 *U*
Chlorinated Benzenes									
1,2–Dichlorobenzene		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
1,4–Dichlorobenzene		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
1,2,4–Trichlorobenzene		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Hexachlorobenzene		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*

TABLE 3. (cont.)

Chemical	Station Number W4–02 Sample Number WE002	W4–02 WE025	W4–03 WE003	W2–01 WE004	W2–02 WE005	SR–01 WE007	SR–02 WE006	SR–03 WE008
Phthalate Esters								
Dimethyl phthalate	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Diethyl phthalate	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Di–n–butyl phthalate	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Butyl benzyl phthalate	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
bis[2–ethylhexyl]phthalate	28 *U*	94	35	110	21 *U*	92	46	190
Di–*n*–octyl phthalate	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Miscellaneous								
Dibenzofuran	28 *U*	25 *U*	21 *U*	13 *J*	21 *U*	22 *U*	11 *J*	30 *U*
Hexachlorobutadiene	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
N–Nitrosodiphenylamine	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Total PCBs	10.8	10.9	7.3	329	73.0 *U*	7.5	8.4	11.5
Ionizable Organic Compounds (µg/kg dry weight)								
Phenol	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
2–Methylphenol	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
4–Methylphenol	60	41	21 *U*	25 *U*	21 *U*	13 *J*	38	34
2,4–Dimethylphenol	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Pentachlorophenol	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Benzyl alcohol	28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*
Benzoic acid	68 *U*	53 *U*	21 *U*	25 *J*	21 *U*	16 *J*	29	28 *J*

TABLE 3. (cont.)

Chemical	Station Number W5–01 Sample Number WE011	W5–02 WE010	W5–03 WE009	W5–04 WE012	ES–01 WE021	HM–03 WE022	HM–05 WE023
Metals (mg/kg dry weight)							
Arsenic	6.7 *J*	9.9 *J*	9.8	5.7 *J*	6.8	3.3	10.9
Cadmium	0.29 *U*	0.37 *U*	0.86 *U*	0.29 *U*	0.45 *U*	0.31	1.4
Chromium	31.4	44.7	39.6	43	34.7	26.1	54.3
Copper	22.8	36.7	35	32.8	23	4.9	32.3
Lead	10.3	8	11.1	9.2	5.9	2.9	7.8
Mercury	0.07 *U*	0.07 *U*	0.09 *U*	0.07 *U*	0.17	0.06 *U*	0.12
Silver	0.28 *U*	0.35 *U*	0.83 *U*	0.32	0.43 *U*	0.25 *U*	0.43 *U*
Zinc	57.5	65.5	64.2	59.9	51.3	21.7	66.3
Nonionizable Organic Compounds (mg/kg dry weight) [a,b]							
Aromatic Hydrocarbons							
Total LPAH [c]	132	148	2836	159	125	120	192
Naphthalene	12 *J*	28 *U*	83	22 *J*	23 *U*	20 *U*	32 *U*
Acenaphthylene	23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Acenaphthene	23 *U*	28 *U*	490	24 *U*	23 *U*	20 *U*	32 *U*
Fluorene	23 *U*	28 *U*	410	12 *J*	23 *U*	20 *U*	32 *U*
Phenanthrene	28	24 *J*	1500 *J*	46	10 *J*	20 *U*	32 *U*
Anthracene	23 *U*	12 *J*	320	31	23 *U*	20 *U*	32 *U*
2–Methylnaphthalene	23 *U*	28 *U*	110	24 *U*	23 *U*	20 *U*	32 *U*
Total HPAH [d]	278	411	3869	428	196	200	302
Fluoranthene	67	99	850	110	24	20 *U*	32 *U*
Pyrene	44	78	1300 *J*	73	18 *J*	20 *U*	14 *J*
Benzo[a]anthracene	17 *J*	30	500	38	11 *J*	20 *U*	32 *U*
Chrysene	31	43	350	59	16 *J*	20 *U*	32 *U*
Total benzofluoranthenes[d]	37 *J*	57 *J*	660	72 *J*	35 *UJ*	40 *U*	64 *U*
Benzo[a]pyrene	13 *J*	20 *J*	110	24 *J*	23 *U*	20 *U*	32 *U*
Indeno[1,2,3–cd]pyrene	23 *U*	28 *U*	33 *U*	14 *J*	23 *U*	20 *U*	32 *U*
Dibenz[a,h]anthracene	23 *U*	28 *U*	33 *U*	24 *J*	23 *U*	20 *U*	32 *U*
Benzo[ghi]perylene	23 *U*	28 *U*	33 *U*	14 *J*	23 *U*	20 *U*	32 *U*
Chlorinated Benzenes							
1,2–Dichlorobenzene	23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
1,4–Dichlorobenzene	23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
1,2,4–Trichlorobenzene	23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Hexachlorobenzene	23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*

TABLE 3. (cont.)

Chemical	Station Number / Sample Number	W5–01 WE011	W5–02 WE010	W5–03 WE009	W5–04 WE012	ES–01 WE021	HM–03 WE022	HM–05 WE023
Phthalate Esters								
Dimethyl phthalate		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Diethyl phthalate		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Di–n–butyl phthalate		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Butyl benzyl phthalate		10 *J*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
bis[2–ethylhexyl] phthalate		120	73	33 *U*	49	23 *U*	20 *U*	32 *U*
Di–*n*–octyl phthalate		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Miscellaneous								
Dibenzofuran		23 *U*	28 *U*	300	24 *U*	23 *U*	20 *U*	32 *U*
Hexachlorobutadiene		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
N–Nitrosodiphenylamine		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Total PCBs		9.5	11.1	10.3 *U*	20.8	13.8	6.4 *U*	11.7
Ionizable Organic Compounds (µg/kg dry weight)								
Phenol		23 *U*	28 *U*	54	24 *U*	120	20 *U*	32 *U*
2–Methylphenol		23 *U*	28 *U*	18 *J*	24 *U*	23 *U*	20 *U*	32 *U*
4–Methylphenol		23 *U*	28 *U*	790	24 *U*	880	35	32 *U*
2,4–Dimethylphenol		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Pentachlorophenol		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*
Benzyl alcohol		23 *U*	28 *U*	23 *J*	24 *U*	23 *U*	20 *U*	32 *U*
Benzoic acid		23 *U*	28 *U*	65	24 *U*	36	14 *J*	29 *J*

Note: HPAH – high molecular weight polycyclic aromatic hydrocarbon
LPAH – low molecular weight polycyclic aromatic hydrocarbon
PCBs – polychlorinated biphenyls

Qualifiers: *J* – estimated
U – undetected at the stated detection limit

[a] Where values in this table represent the sums of individual compounds (e.g., total LPAHs and total HPAHs) or groups of isomers (e.g., total PCBs) and a chemical analysis identified an undetected value for one or more individual compounds or groups of isomers, the detection limit is used for calculating the sum of the respective compounds or groups of isomers.

[b] Total LPAH represents the sum of the concentrations of the following LPAH compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. 2–Methylnaphthalene is not included in the total LPAH definition. The total LPAH SQS and CSL criteria are not the sums of the corresponding SQS and CSL criteria listed for the individual LPAH compounds.

[c] Total HPAH represents 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 SQS and CSL criteria are not the sums of the corresponding SQS and CSL criteria listed for the individual HPAH compounds.

[d] Total benzofluoranthenes represents the sum of the concentrations of the b, j, and k isomers of benzofluoranthene.

TABLE 4. SEDIMENT CONCENTRATIONS (DRY–WEIGHT BASIS) OF POLYCHLORINATED DIBENZO–*p*–DIOXINS (PCDDs) AND POLYCHLORINATED DIBENZOFURANS (PCDFs)

Chemical	Station Number / Sample Number	W1–01 WE013	W1–02 WE014	W1–03 WE015	SS–01 WE016	SS–02 WE017	SS–03 WE018	SS–04 WE019	SS–05 WE020
PCDDs (ng/kg dry weight)									
2378–TCDD		4.02	1.69	1.11	0.20 *U*	0.56 *U*	0.32 *U*	1.63	0.38 *U*
12378–PeCDD		1.07	2.20 *U*	1.93 *U*	0.45 *U*	0.55 *U*	0.55 *U*	1.09 *U*	0.57 *U*
123478–HxCDD		1.34	1.11 *U*	1.22	1.17 *U*	0.63 *U*	0.89 *U*	0.64 *U*	0.49 *U*
123678–HxCDD		9.94	6.30	5.64	0.81	0.79	0.99	2.10	1.28 *U*
123789–HxCDD		5.86	3.97	4.29	0.96 *U*	0.53	0.60	1.39	1.07 *U*
1234789–HpCDD		78.8	45.6	59.5	7.43	6.67	7.71	14.1	3.20
OCDD		645	324	425	55.5	49.1	50.6	104	24.4
PCDFs (ng/kg dry weight)									
2378–TCDF		43.9	17.1	11.5	1.32	1.96	1.75	14.2	1.06
12378–PeCDF		1.59	1.19 *U*	0.78 *U*	0.11 *U*	0.24 *U*	0.21 *U*	0.49 *U*	0.41 *U*
23478–PeCDF		2.74	0.32 *U*	1.07	0.20 *U*	0.49 *U*	0.21 *U*	0.76	0.84 *U*
123478–HxCDF		1.94	1.26	1.33	0.28 *U*	0.14 *U*	0.40 *U*	0.84 *U*	0.61
123678–HxCDF		0.82	0.58	0.66	0.50 *U*	0.20 *U*	0.16	0.44 *U*	0.35
123789–HxCDF		0.31 *U*	0.29 *U*	0.41 *U*	0.13 *U*	0.15 *U*	0.29 *U*	0.50 *U*	0.43 *U*
234678–HxCDF		1.32	1.22	1.10	0.69	0.58	0.68		0.73
1234678–HpCDF		8.12	7.12	9.45	1.07	1.04	0.96	2.04	1.20
1234789–HpCDF		0.58	1.29 *U*	1.16 *U*	0.21 *U*	0.22 *U*	0.18 *U*	0.63 *U*	0.34
OCDF		17.1	13.5	18.4	1.58	1.92	2.11	3.97	1.55
Total TCDD		14.1	17.1	12.2	1.80			5.41	
Total PeCDD		6.38	11.0	12.4			0.77	1.33	
Total HxCDD		80.9	54.8	57.4	6.34	6.94	10.4	17.9	2.86
Total HpCDD		230	116	144	17.0	15.2	19.1	37.2	7.26
Total TCDF		82.3	34.8	26.9	1.32	1.96	2.27	23.0	1.06
Total PeCDF		11.1	3.69	6.81				1.96	0.59
Total HxCDF		14.0	11.4	15.6	1.87	1.89	2.49	2.98	2.62
Total HpCDF		22.3	17.2	24.0	2.37	2.38	2.19	5.03	2.46

TABLE 4. (cont.)

Chemical / Station Number / Sample Number	W4–01 WE001	W4–02 WE002	W4–02 WE025	W4–03 WE003	W2–01 WE004	W2–02 WE005	SR–01 WE007	SR–02 WE006
PCDDs (ng/kg dry weight)								
2378–TCDD	0.37 *U*	0.57	0.30 *U*	0.56 *U*	0.51	0.77 *U*	0.52 *U*	0.70 *U*
12378–PeCDD	0.63 *U*	0.33 *U*	1.14 *U*	0.20 *U*	1.29	1.49 *U*	0.83 *U*	0.99 *U*
123478–HxCDD	1.45 *U*	0.54	1.42 *U*	0.58 *U*	1.76	0.56	0.80 *U*	0.95
123678–HxCDD	3.10	2.27	7.26	0.85	6.63	2.70	1.88	3.56
123789–HxCDD	2.82	1.46	2.45	0.42	5.28	1.73	1.34	2.31
1234789–HpCDD	56.6	39.9	263	9.33	145	33.4	25.7	47.4
OCDD	525	3950	4140	80.7	1240	264	228	245
PCDFs (ng/kg dry weight)								
2378–TCDF	1.40	0.90	1.20	1.03 *U*	5.75	1.01	1.32	1.32
12378–PeCDF	0.24 *U*	0.71 *U*	0.78 *U*	0.48 *U*	1.39	0.28 *U*	0.34 *U*	0.39 *U*
23478–PeCDF	0.45	0.61 *U*	1.18 *U*	0.65 *U*	1.81	0.88 *U*	0.65 *U*	0.73 *U*
123478–HxCDF	0.84	1.54	3.46	0.73	4.37	0.89	1.62 *U*	0.70 *U*
123678–HxCDF	0.44	0.53	0.81	0.24	1.94 *U*	0.43	0.97 *U*	1.33 *U*
123789–HxCDF	0.18 *U*	0.24 *U*	0.46 *U*	0.29 *U*	0.36 *U*	0.52 *U*	0.24 *U*	0.41 *U*
234678–HxCDF	0.87	0.83	1.55	0.86	2.51	1.11	0.93	1.03
1234678–HpCDF	10.6	10.2	27.6	2.27	45.7	6.83	4.96	13.1
1234789–HpCDF	0.68	0.41	1.51	0.23 *U*	2.21	0.54	0.61 *U*	0.46 *U*
OCDF	35.1	29.9	142	4.37	125	11.8	12.7	24.8
Total TCDD	6.50	5.47	3.87	1.03	9.75		1.15	0.71
Total PeCDD	3.33				6.92			
Total HxCDD	24.0	20.0	27.6	5.42	54.8	17.3	16.2	19.4
Total HpCDD	143	101	477	23.2	402	77.1	70.1	91.0
Total TCDF	3.41	1.66	2.48		23.3	1.50	1.32	1.32
Total PeCDF	3.42	1.89	1.75	0.82	16.5			
Total HxCDF	13.3	7.50	30.7	4.07	52.2	11.8	7.45	14.9
Total HpCDF	32.9	29.5	136	5.77	47.9	7.38	13.2	36.5

TABLE 4. (cont.)

Chemical	Station Number / Sample Number	SR–03 WE008	W5–01 WE011	W5–02 WE010	W5–03 WE009	W5–04 WE012	ES–01 WE021	HM–03 WE022	HM–05 WE023
PCDDs (ng/kg dry weight)									
2378–TCDD		0.65 *U*	0.76 *U*	0.28 *U*	0.43 *U*	0.45 *U*	0.24 *U*	0.30 *U*	0.29 *U*
12378–PeCDD		0.76 *U*	0.31 *U*	0.42 *U*	0.69 *U*	0.45	0.36 *U*	0.16 *U*	0.96 *U*
123478–HxCDD		1.26	0.69 *U*	0.97 *U*	0.88 *U*	0.72	0.77 *U*	0.72 *U*	0.90 *U*
123678–HxCDD		4.38	1.64	1.33	2.48	2.25	0.74 *U*	0.73 *U*	1.49
123789–HxCDD		2.99	1.11	1.32	1.72	1.52	0.50 *U*	0.66 *U*	1.46
1234789–HpCDD		80.1	38.4	24.6	51.5	38.4	1.63	1.64	14.7
OCDD		674	276	229	478	306	9.02	10.2	88.5
PCDFs (ng/kg dry weight)									
2378–TCDF		2.82	2.00	0.87	0.93	3.18	0.47 *U*	0.38	1.68
12378–PeCDF		0.41 *U*	0.54 *U*	0.24 *U*	0.44 *U*	0.51 *U*	0.24 *U*	0.17 *U*	0.35 *U*
23478–PeCDF		1.36 *U*	0.94 *U*	0.40	0.67 *U*	0.67	0.23 *U*	0.35 *U*	0.53
123478–HxCDF		1.39	1.30	1.21	0.55	1.55	0.39	0.42 *U*	0.61
123678–HxCDF		0.73	0.52	0.41	0.50 *U*	0.75	0.20	0.40 *U*	0.39
123789–HxCDF		0.43 *U*	0.22 *U*	0.11 *U*	0.17 *U*	0.25 *U*	0.14 *U*	0.16 *U*	0.24 *U*
234678–HxCDF		1.35	0.82	0.82	0.94	0.94	0.52	0.51	0.85
1234678–HpCDF		12.7	5.73	3.72	3.46	10.1	0.67	0.41	2.87
1234789–HpCDF		1.00 *U*	0.88 *U*	0.66 *U*	0.51 *U*	0.58	0.33 *U*	0.21 *U*	0.62 *U*
OCDF		36.5	12.4	8.45	11.8	22.8	0.82	0.90	4.69
Total TCDD		10.8	5.63	4.47	2.44	15.3			5.19
Total PeCDD		9.56	2.52	1.11	1.16	6.52			1.10
Total HxCDD		42.2	15.8	14.6	27.7	25.2			14.5
Total HpCDD		212	87.6	67.8	220	91.2	3.22	3.56	31.6
Total TCDF		3.85	2.00	1.90	0.93	17.1		0.38	6.10
Total PeCDF		4.23	1.71	1.80	1.29	5.71			3.00
Total HxCDF		18.1	8.63	5.02	7.00	15.0	1.12	0.51	4.62
Total HpCDF		36.6	15.8	10.6	10.5	28.9	0.67	0.89	6.06

Note: The absence of a total concentration value for a group of congeners indicates that the total concentration of those congeners could not be quantitated.

Qualifer: *U* – undetected at the stated detection limit

TABLE 5. SEDIMENT GRAIN–SIZE DISTRIBUTION, TOTAL ORGANIC CARBON CONTENT, SULFIDE CONCENTRATION, AND INTERSTITIAL SALINITY

Station	Grain–Size Fraction (percent)					TOC (percent)	Total Sulfides (mg/kg dry)	Interstitial Salinity[b] (ppt)
	Gravel	Sand	Silt	Clay	Fines[a]			
W1–01	0.0	5.0	66.7	28.3	95.0	3.1	233	17.5
W1–02	0.0	14.6	61.5	23.9	85.4	3.3	98.6	18.0
W1–03	0.0	7.6	64.1	28.2	92.3	3.6	114	18.0
SS–01	0.0	83.9	12.4	3.7	16.1	0.56	2.5	--
SS–02	0.0	84.6	12.4	3.0	15.4	0.49	7.1	14.0
SS–03	0.0	84.8	12.2	3.0	15.2	0.59	6.1	--
SS–04	0.0	61.7	32.0	6.2	38.2	0.93	78.8	--
SS–05	0.0	92.0	5.9	2.1	8.0	0.21	0.12	--
W4–01	0.0	14.7	70.8	14.5	85.3	2.4	221	--
W4–02	0.0	37.6	48.2	14.1	62.3	1.9	53.0	--
W4–02	0.0	38.7	48.8	12.5	61.3	1.7	37.8	--
W4–03	0.0	89.0	9.4	1.6	11.0	0.80	3.2	12.0
W2–01	0.0	40.8	51.8	7.5	59.3	1.7	34.9	5.5
W2–02	0.7	83.4	12.6	3.3	15.9	0.88	1.0	6.0
SR–01	0.0	54.1	38.5	7.4	45.9	1.0	32.5	14.0
SR–02	0.4	84.6	13.0	2.1	15.1	1.9	1.8	--
SR–03	0.0	17.3	67.0	15.7	82.7	2.7	73.9	--
W5–01	0.0	76.9	18.5	4.6	23.1	1.4	7.7	11.5
W5–02	0.0	28.7	60.3	11.0	71.3	1.7	72.3	21.0
W5–03	0.0	64.2	25.2	10.6	35.8	8.9	148	15.0
W5–04	0.0	48.9	44.4	6.7	51.1	1.6	13.7	10.5
ES–01	0.0	77.0	17.6	5.4	23.0	1.2	84.3	17.0
HM–03	0.0	95.1	3.1	1.8	4.9	0.16	0.50	30.0
HM–05	0.0	27.9	49.5	22.6	72.1	1.7	28.4	28.0

Note: TOC – total organic carbon
-- – interstitial salinity not measured
ppt – parts per thousand

[a] Fines – fine–grained fraction (i.e., silt plus clay)

[b] The salinity of interstitial water for the sediment samples submitted for toxicity testing was measured by Northwestern Aquatic Sciences using a refractometer.

TABLE 6. COMPARISON OF CHEMICAL RESULTS TO SEDIMENT QUALITY STANDARDS AND CLEANUP SCREENING LEVELS FOR PUGET SOUND MARINE SEDIMENTS

Chemical	Station Number / Sample Number	W1–01 WE013	W1–02 WE014	W1–03 WE015	SS–01 WE016	SS–02 WE017	SS–03 WE018	SS–04 WE019	SS–05 WE020	W4–01 WE001	SQS	CSL
Metals (mg/kg dry weight)												
Arsenic		11.2 *J*	9.7	15.9	5.2	5.2	6.0	5.0	5.0	11.0	57	93
Cadmium		0.56 *U*	0.46 *U*	0.60 *U*	0.27 *U*	0.29 *U*	0.29 *U*	0.37 *U*	0.39 *U*	0.47 *U*	5.1	6.7
Chromium		64.7	54.1	65.2	32.0	28.6	28.8	38.7	26.5	51.5	260	270
Copper		53.1	49.0	60.9	22.0	20.9	19.3	26.2	16.5	48.6	390	390
Lead		11.1	11.0	14.0	4.6	4.5	4.6	6.4	3.4	11.2	450	530
Mercury		0.12 *U*	0.39	0.16	0.13	0.06 *U*	0.10	0.06 *U*	0.06 *U*	0.14	0.41	0.59
Silver		0.66	0.44 *U*	0.57 *U*	0.26 *U*	0.28 *U*	0.28 *U*	0.36 *U*	0.38 *U*	0.45 *U*	6.1	6.1
Zinc		88.2	79.2	95.1	48.6	44.6	51	55.2	42.9	78.1	410	960
Nonionizable Organic Compounds (mg/kg organic carbon) [a,b]												
Aromatic Hydrocarbons												
Total LPAH [c]		9.7	6.2	6.4	23	26	21	14	51	8.3	370	780
Naphthalene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	99	170
Acenaphthylene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	66	66
Acenaphthene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	16	57
Fluorene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	23	79
Phenanthrene		3.5	0.91 *J*	0.75 *J*	3.8 *U*	4.3 *U*	3.6 *U*	1.4 *J*	8.6 *U*	1.5	100	480
Anthracene		1.0 *J*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.2 *J*	220	1200
2–Methylnaphthalene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	38	64
Total HPAH [d]		32	16	14	38	38	34	21	86	25	960	5300
Fluoranthene		7.1	3.3	2.8	3.8 *U*	1.8 *J*	3.6 *U*	2.9	8.6 *U*	4.6	160	1200
Pyrene		6.5	1.8	1.6	3.8 *U*	4.3 *U*	3.6 *U*	2.2 *J*	8.6 *U*	4.6	1000	1400
Benzo[a]anthracene		2.5	1.2	0.75 *J*	3.8 *U*	4.3 *U*	3.6 *U*	1.1 *J*	8.6 *U*	2.3	110	270
Chrysene		5.5	2.8	1.6	3.8 *U*	4.3 *U*	3.6 *U*	1.7 *J*	8.6 *U*	3.8	110	460
Total benzofluoranthenes [e]		5.7	2.3 *J*	2.5 *U*	7.5 *U*	8.6 *U*	5.9 *UJ*	3.5 *UJ*	17 *U*	4.8 *J*	230	450
Benzo[a]pyrene		1.7	1.1 *U*	1.1 *U*	3.8 *U*	1.6 *J*	3.6 *U*	2.0 *J*	8.6 *U*	1.7	99	210
Indeno[1,2,3–cd]pyrene		0.77 *J*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	0.71 *J*	34	88
Dibenz[a,h]anthracene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	12	33
Benzo[ghi]perylene		0.77 *J*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	31	78
Chlorinated Benzenes												
1,2–Dichlorobenzene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	2.3	2.3
1,4–Dichlorobenzene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	3.1	9.0
1,2,4–Trichlorobenzene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	0.81	1.8
Hexachlorobenzene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	0.38	2.3

TABLE 6. (cont.)

Chemical	Station Number / Sample Number	W1–01 WE013	W1–02 WE014	W1–03 WE015	SS–01 WE016	SS–02 WE017	SS–03 WE018	SS–04 WE019	SS–05 WE020	W4–01 WE001	SQS	CSL
Phthalate Esters												
Dimethyl phthalate		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	53	53
Diethyl phthalate		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	61	110
Di–*n*–butyl phthalate		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	220	1700
Butyl benzyl phthalate		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	4.9	64
bis[2–ethylhexyl]phthalate		2.0	1.1 *U*	1.1 *U*	4.8	3.3 *J*	3.6 *U*	1.9 *J*	4.3 *J*	5.0	47	78
Di–*n*–octyl phthalate		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	58	4500
Miscellaneous												
Dibenzofuran		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	15	58
Hexachlorobutadiene		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	3.9	6.2
N–Nitrosodiphenylamine		1.3 *U*	1.1 *U*	1.1 *U*	3.8 *U*	4.3 *U*	3.6 *U*	2.5 *U*	8.6 *U*	1.4 *U*	11	11
Total PCBs		0.44 *U*	0.31 *U*	0.53	1.2	1.3	1.2	0.91	3.0 *U*	0.67 *U*	12	65
Ionizable Organic Compounds (µg/kg dry weight)												
Phenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*	420	1200
2–Methylphenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*	63	63
4–Methylphenol		40 *U*	35 *U*	23 *J*	21 *U*	21 *U*	21 *U*	15 *J*	18 *U*	20 *J*	670	670
2,4–Dimethylphenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*	29	29
Pentachlorophenol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*	360	690
Benzyl alcohol		40 *U*	35 *U*	41 *U*	21 *U*	21 *U*	21 *U*	23 *U*	18 *U*	33 *U*	57	73
Benzoic acid		40 *U*	28 *J*	37 *J*	21 *U*	21 *U*	10 *J*	17 *J*	10 *J*	68 *U*	650	650

TABLE 6. (cont.)

Chemical	Station Number / Sample Number	W4–02 WE002	W4–02 WE025	W4–03 WE003	W2–01 WE004	W2–02 WE005	SR–01 WE007	SR–02 WE006	SR–03 WE008	SQS	CSL
Metals (mg/kg dry weight)											
Arsenic		9.9	11.8	4.4	7.8	5.6	8.3	6.5	10.2	57	93
Cadmium		0.37 *U*	0.38 *U*	0.30 *U*	0.52 *U*	0.44 *U*	0.44 *U*	0.44 *U*	0.56 *U*	5.1	6.7
Chromium		50.4	43.4	30.9	40.0	29.6	34.0	28.0	51.4	260	270
Copper		42.4	38.3	19.5	34.7	26.8	27.7	21.6	47.1	390	390
Lead		10.7	8.3	6.4	9.9	7.5	11.6	6.3	11.4	450	530
Mercury		0.16	0.09	0.058	0.069	0.05 *U*	0.06 *U*	0.06 *U*	0.11	0.41	0.59
Silver		0.36 *U*	0.37 *U*	0.32	0.50 *U*	0.42 *U*	0.43 *U*	0.42 *U*	0.53 *U*	6.1	6.1
Zinc		77.5	66.5	45.9	68.5	53.0	55.7	47.3	85.5	410	960
Nonionizable Organic Compounds (mg/kg organic carbon) [a,b]											
Aromatic Hydrocarbons											
Total LPAH [c]		8.5	8.6	14	17	12	13	12	8.2	370	780
Naphthalene		1.5 *U*	1.5 *U*	2.6 *U*	1.4 *J*	1.0 *J*	1.1 *J*	0.84 *J*	0.78 *J*	99	170
Acenaphthylene		1.5 *U*	1.5 *U*	2.6 *U*	0.82 *J*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	66	66
Acenaphthene		1.5 *U*	1.5 *U*	2.6 *U*	1.6	2.4 *U*	2.2 *U*	0.53 *J*	0.59 *J*	16	57
Fluorene		1.5 *U*	1.5 *U*	2.6 *U*	1.4 *J*	2.4 *U*	2.2 *U*	1.1 *J*	0.89 *J*	23	79
Phenanthrene		1.7	1.8	2.6	8.8	1.3 *J*	2.7	3.0	2.6	100	480
Anthracene		0.8 *J*	0.9 *J*	1.1 *J*	3.1	2.4 *U*	2.2 *U*	5.0	2.3	220	1200
2–Methylnaphthalene		1.5 *U*	1.5 *U*	2.6 *U*	0.65 *J*	2.4 *U*	2.2 *U*	0.63 *J*	1.1 *U*	38	64
Total HPAH [d]		28	27	31	150	59	35	32	37	960	5300
Fluoranthene		5.8	5.2	5.8	39	9.9	8.3	6.3	12	160	1200
Pyrene		5.3	4.9	6.0	27	5.7	5.8	6.3	6.3	1000	1400
Benzo[a]anthracene		2.5	2.4	2.5 *J*	12	5.2	2.7	4.2	3.5	110	270
Chrysene		4.4	4.5	3.3	26	20	4.7	4.8	5.9	110	460
Total benzofluoranthenes [e]		4.4	4.8	4.0 *J*	26	9.7	4.8 *J*	4.4 *J*	5.2 *U*	230	450
Benzo[a]pyrene		1.5	2.0	1.9 *J*	8.8	2.8	1.8 *J*	2.2	1.1 *U*	99	210
Indeno[1,2,3–cd]pyrene		1.47 *U*	1.00 *J*	2.6 *U*	5.6	1.6 *J*	2.2 *U*	1.2 *U*	1.1 *U*	34	88
Dibenz[a,h]anthracene		1.5 *U*	0.8 *J*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	12	33
Benzo[ghi]perylene		1.5 *U*	1.5 *U*	2.6 *U*	4.4	1.0 *J*	2.2 *U*	1.2 *U*	1.1 *U*	31	78
Chlorinated Benzenes											
1,2–Dichlorobenzene		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	2.3	2.3
1,4–Dichlorobenzene		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	3.1	9.0
1,2,4–Trichlorobenzene		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	0.81	1.8
Hexachlorobenzene		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	0.38	2.3

TABLE 6. (cont.)

Chemical	Station Number / Sample Number	W4–02 WE002	W4–02 WE025	W4–03 WE003	W2–01 WE004	W2–02 WE005	SR–01 WE007	SR–02 WE006	SR–03 WE008	SQS	CSL
Phthalate Esters											
Dimethyl phthalate		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	53	53
Diethyl phthalate		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	61	110
Di–*n*–butyl phthalate		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	220	1700
Butyl benzyl phthalate		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	4	64
bis[2–ethylhexyl]phthalate		1.5 *U*	5.5	4.4	6.5	2.4 *U*	9.2	2.4	7.0	47	78
Di–*n*–octyl phthalate		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	58	4500
Miscellaneous											
Dibenzofuran		1.5 *U*	1.5 *U*	2.6 *U*	0.76 *J*	2.4 *U*	2.2 *U*	0.58 *J*	1.1 *U*	15	58
Hexachlorobutadiene		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	3.9	6.2
N–Nitrosodiphenylamine		1.5 *U*	1.5 *U*	2.6 *U*	1.5 *U*	2.4 *U*	2.2 *U*	1.2 *U*	1.1 *U*	11	11
Total PCBs		0.57	0.64	0.91	19 *f*	8.3 *U*	0.75	0.44	0.43	12	65
Ionizable Organic Compounds (µg/kg dry weight)											
Phenol		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*	420	1200
2–Methylphenol		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*	63	63
4–Methylphenol		60	41	21 *U*	25 *U*	21 *U*	13 *J*	38	34	670	670
2,4–Dimethylphenol		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*	29	29
Pentachlorophenol		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*	360	690
Benzyl alcohol		28 *U*	25 *U*	21 *U*	25 *U*	21 *U*	22 *U*	22 *U*	30 *U*	57	73
Benzoic acid		68 *U*	53 *U*	21 *U*	25 *J*	21 *U*	16 *J*	29	28 *J*	650	650

TABLE 6. (cont.)

Chemical	Station Number W5–01 / Sample Number WE011	W5–02 / WE010	W5–03 / WE009	W5–04 / WE012	ES–01 / WE021	HM–03 / WE022	HM–05 / WE023	SQS	CSL
Metals (mg/kg dry weight)									
Arsenic	6.7 *J*	9.9 *J*	9.8	5.7 *J*	6.8	3.3	10.9	57	93
Cadmium	0.29 *U*	0.37 *U*	0.86 *U*	0.29 *U*	0.45 *U*	0.31	1.4	5.1	6.7
Chromium	31.4	44.7	39.6	43.0	34.7	26.1	54.3	260	270
Copper	22.8	36.7	35.0	32.8	23.0	4.9	32.3	390	390
Lead	10.3	8.0	11.1	9.2	5.9	2.9	7.8	450	530
Mercury	0.07 *U*	0.07 *U*	0.09 *U*	0.07 *U*	0.17	0.06 *U*	0.12	0.41	0.59
Silver	0.28 *U*	0.35 *U*	0.83 *U*	0.32	0.43 *U*	0.25 *U*	0.43 *U*	6.1	6.1
Zinc	57.5	65.5	64.2	59.9	51.3	21.7	66.3	410	960
Nonionizable Organic Compounds (mg/kg organic carbon) [a,b]									
Aromatic Hydrocarbons									
Total LPAH [c]	9.4	8.7	32	9.9	10	75	11	370	780
Naphthalene	0.86 *J*	1.6 *U*	0.93	1.4 *J*	1.9 *U*	13 *U*	1.9 *U*	99	170
Acenaphthylene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	66	66
Acenaphthene	1.6 *U*	1.6 *U*	5.5	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	16	57
Fluorene	1.6 *U*	1.6 *U*	4.6	0.75 *J*	1.9 *U*	13 *U*	1.9 *U*	23	79
Phenanthrene	2.0	1.4 *J*	17 *J*	2.9	0.83 *J*	13 *U*	1.9 *U*	100	480
Anthracene	1.6 *U*	0.71 *J*	3.6	1.9	1.9 *U*	13 *U*	1.9 *U*	220	1200
2–Methylnaphthalene	1.6 *U*	1.6 *U*	1.2	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	38	64
Total HPAH [d]	20	24	43	27	16	125	18	960	5300
Fluoranthene	4.8	5.8	9.6	6.9	2.0	13 *U*	1.9 *U*	160	1200
Pyrene	3.1	4.6	15 *J*	4.6	1.5 *J*	13 *U*	0.82 *J*	1000	1400
Benzo[a]anthracene	1.2 *J*	1.8	5.6	2.4	0.92 *J*	13 *U*	1.9 *U*	110	270
Chrysene	2.2	2.5	3.9	3.7	1.3 *J*	13 *U*	1.9 *U*	110	460
Total benzofluoranthenes [e]	2.6 *J*	3.4 *J*	7.4	4.5 *J*	2.9 *UJ*	25 *U*	3.8 *U*	230	450
Benzo[a]pyrene	0.93 *J*	1.2 *J*	1.2	1.5 *J*	1.9 *U*	13 *U*	1.9 *U*	99	210
Indeno[1,2,3–cd]pyrene	1.6 *U*	1.6 *U*	0.37 *U*	0.88 *J*	1.9 *U*	13 *U*	1.9 *U*	34	88
Dibenz[a,h]anthracene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *J*	1.9 *U*	13 *U*	1.9 *U*	12	33
Benzo[ghi]perylene	1.6 *U*	1.6 *U*	0.37 *U*	0.88 *J*	1.9 *U*	13 *U*	1.9 *U*	31	78
Chlorinated Benzenes									
1,2–Dichlorobenzene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	2.3	2.3
1,4–Dichlorobenzene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	3.1	9.0
1,2,4–Trichlorobenzene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	0.81	1.8
Hexachlorobenzene	1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	0.38	2.3

TABLE 6. (cont.)

Chemical	Station Number / Sample Number	W5–01 WE011	W5–02 WE010	W5–03 WE009	W5–04 WE012	ES–01 WE021	HM–03 WE022	HM–05 WE023	SQS	CSL
Phthalate Esters										
Dimethyl phthalate		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	53	53
Diethyl phthalate		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	61	110
Di–*n*–butyl phthalate		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	220	1700
Butyl benzyl phthalate		0.71 *J*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	4.9	64
bis[2–ethylhexyl]phthalate		8.6	4.3	0.37 *U*	3.1	1.9 *U*	13 *U*	1.9 *U*	47	78
Di–*n*–octyl phthalate		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	58	4500
Miscellaneous										
Dibenzofuran		1.6 *U*	1.6 *U*	3.4	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	15	58
Hexachlorobutadiene		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	3.9	6.2
N–Nitrosodiphenylamine		1.6 *U*	1.6 *U*	0.37 *U*	1.5 *U*	1.9 *U*	13 *U*	1.9 *U*	11	11
Total PCBs		0.68	0.65	0.12 *U*	1.3	1.1	4.0 *U*	0.69	12	65
Ionizable Organic Compounds (µg/kg dry weight)										
Phenol		23 *U*	28 *U*	54	24 *U*	120	20 *U*	32 *U*	420	1200
2–Methylphenol		23 *U*	28 *U*	18 *J*	24 *U*	23 *U*	20 *U*	32 *U*	63	63
4–Methylphenol		23 *U*	28 *U*	790 *f,g*	24 *U*	880 *f,g*	35	32 *U*	670	670
2,4–Dimethylphenol		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*	29	29
Pentachlorophenol		23 *U*	28 *U*	33 *U*	24 *U*	23 *U*	20 *U*	32 *U*	360	690
Benzyl alcohol		23 *U*	28 *U*	23 *J*	24 *U*	23 *U*	20 *U*	32 *U*	57	73
Benzoic acid		23 *U*	28 *U*	65	24 *U*	36	14 *J*	29 *J*	650	650

Note: CSL – cleanup screening levels (WAC 173–204–520)
HPAH – high molecular weight polycyclic aromatic hydrocarbon
LPAH – low molecular weight polycyclic aromatic hydrocarbon
PCBs – polychlorinated biphenyls
SQS – sediment quality standards (WAC 173–204–320)

Qualifiers: *J* – estimated
U – undetected at the stated detection limit

[a] Where values in this table represent the sums of individual compounds (e.g., total LPAHs and total HPAHs) or groups of isomers (e.g., total PCBs) and a chemical analysis identified an undetected value for one or more individual compounds or groups of isomers, the detection limit is used for calculating the sum of the respective compounds or groups of isomers.

TABLE 6. (cont.)

[b] The listed values represent concentrations in parts per million "normalized" on a total organic carbon basis. To normalize to total organic car dry–weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the se

[c] Total LPAH represents the sum of the concentrations of the following LPAH compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. 2–Methylnaphthalene is not included in the total LPAH definition. The total LPAH SQS and CSL crit not the sums of the corresponding SQS and CSL criteria listed for the individual LPAH compounds.

[d] Total HPAH represents the sum of the concentrations of the following HPAH compounds: fluoranthene, pyrene, benz[a]anthracene, chryser total benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3–cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene. The total HPAH SQS ar CSL criteria are not the sums of the corresponding SQS and CSL criteria listed for the individual HPAH compounds.

[e] Total benzofluoranthenes represents the sum of the concentrations of the b, j, and k isomers of benzofluoranthene.

[f] Outlined values indicate exceedance of the SQS criterion.

[g] Shaded values indicate exceedance of the CSL criterion.

to the percent TOC content (i.e., 1 percent = 0.01), yielding a concentration in units of mg/kg organic carbon.

3.1.1 Metals

The concentrations of metals were low and relatively uniform at all 23 stations. None of the metals concentrations exceeded either the SQS or CSL criteria (Table 6).

3.1.2 Semivolatile Organic Compounds

The concentrations of semivolatile organic compounds were generally low at all 23 stations. The only semivolatile organic compound found to exceed either the SQS or CSL criteria was 4-methylphenol (Table 6). This compound exceeded the SQS and CSL criteria (both of which are 670 μg/kg dry weight) at Stations W5-03 and ES-01 (Figure 2). Both exceedances were relatively minor (790 and 880 μg/kg dry weight, respectively). Station W5-03 was located off Outfall WK005 (Figure 2), in an area where there is considerable log rafting; a large amount of wood debris was noted in the sediment sample at this station and the sediment sample had a high TOC content (see Section 3.1.5). Station ES-01 was the local background station and was also in an area where there is considerable log rafting. 4-Methylphenol is commonly associated with wood debris in sediment samples.

3.1.3 Polychlorinated Biphenyls

The concentrations of total PCBs (Table 6) exceeded the SQS criterion (12 mg/kg organic carbon) only at Station W2-01 (19 mg/kg organic carbon), but none of the PCB concentrations exceeded the CSL criterion (65 mg/kg organic carbon). Station W2-01 was located off Outfall WK002 (Figure 2).

3.1.4 Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans

At the very low concentrations (ng/kg dry weight, parts per trillion) that can be detected in environmental samples, PCDDs and PCDFs are generally found to be ubiquitous in the environment. Not surprisingly, certain PCDD and PCDF congeners were detected in every sediment sample (Table 4). The concentrations of individual congeners were highly variable, however. There are no SQS or CSL criteria for PCDDs and PCDFs, however, so there is no straightforward method available for judging the ecological significance of the reported PCDD and PCDF concentrations.

3.1.5 Total Organic Carbon

With the exception of one station (Station W5-03; 8.9 percent), there was a relatively narrow range in TOC content (0.16–3.6 percent) among the 23 stations (Table 5). The high TOC content at Station W5-03 (8.9 percent) was likely associated with the large amount of wood debris noted in the sediment sample collected at that station.

3.1.6 Total Sulfides

The concentrations of total sulfides were highly variable among stations, ranging from 0.12 to 233 mg/kg dry weight (Table 5). The higher concentrations of total sulfides were generally found in sediments with higher TOC contents (Table 5), but the relationship was not linear. Station W5-03 had the highest TOC content (8.9 percent) and a total sulfides concentration of 148 mg/kg dry weight. Stations W1-01 and W4-01 had higher total sulfides concentrations (233 and 221 mg/kg, respectively) but lower TOC contents (3.1 and 2.4 percent, respectively).

3.2 GRAIN-SIZE DISTRIBUTION

Sediment grain-size distributions varied widely among stations (Table 5), ranging from 4.9 to 95 percent fine-grained sediments (i.e., silt plus clay) and from 5 to 95.1 percent sand. There was very little gravel in any of the sediment samples (0–0.7 percent).

3.3 BIOLOGICAL ANALYSES

The results of the toxicity tests are reported in Table 7. With one exception, the reference and control sediment test results met the performance standards of the Washington State Sediment Management Standards (WAC 173-204-315(2)). For the amphipod test, the performance standards state that the reference sediment must have less than 25 percent mortality; the reference sediment from Station HM-05 had 25 percent mortality and, therefore, this sample would be of questionable use for comparison with the site stations. The results of all three toxicity tests for the site stations were compared to the results for the reference sediment from Station HM-03. This provided a more restrictive comparison than would have been the case for Station HM-05 because, in comparison to Station HM-05, Station HM-03 had 1) a lower mortality for the amphipod test, 2) a lower abnormality/mortality for the bivalve larvae test, and 3) a roughly equal biomass for the juvenile polychaete test.

The modifications made to the toxicity tests as a result of the low salinity interstitial water in some of the sediment samples (see Section 2.3) appeared to have the desired result. Use of water having a salinity equal to the mean interstitial salinity in the various sediment samples (15.9 ppt) appeared to have no appreciable effect on amphipod survival; mortalities were relatively low in all sediment samples tested. Adjustment of the salinity in the juvenile polychaete toxicity test for sediments having interstitial salinities <20 ppt also appeared to prevent the organisms from experiencing undue osmotic stress; polychaete mortalities were very low (0–4 percent) in all sediment samples tested.

TABLE 7. SUMMARY OF TOXICITY TESTING RESULTS

Station Number	Sample Number	Amphipod Test (% mortality)	Bivalve Larvae Test (combined % mortality and abnormality)	Juvenile Polychaete Test (mean biomass; mg)
Site Stations				
W1-01	WE013	9	76.0[a,b]	38.7
W1-02	WE014	13	81.1[a]	32.4
W1-03	WE015	15	86.9[a]	34.1
W2-01	WE004	3	57.0	38.0
W2-02	WE005	4	61.1	47.6
W4-03	WE003	5	40.3[a]	39.5
W5-01	WE011	2	40.4[a]	31.6[a]
W5-02	WE010	10	57.1	34.7
W5-03	WE009	4	99.5[a,c]	44.4
W5-04	WE012	5	53.1	42.1
SR-01	WE007	7	37.4[a]	46.5
SS-02	WE017	0	41.7[a]	45.3
Local Background				
ES-01	WE021	2	46.2	46.9
Reference Area				
HM-03	WE022	4	59.5	46.4
HM-05	WE023	25	82.3	47.5
Control Samples		1	43.8	43.2
Biological Effects Criteria				
SQS		>25[e]	>74.5[f]	<32.5[g]
CSL		>34[h]	>89.5[i]	<23.2[j]

Note: To provide a more restrictive comparison between the test data and the Sediment Quality Standards (SQS) and Cleanup Screening Level (CSL) biological effects criteria, the toxicity test results were compared to the results for the reference sediment from Station HM-03.

[a] Statistically significant difference ($P \leq 0.05$) between test area and reference area results.

[b] Outlined values indicate exceedance of the SQS biological effects criteria.

[c] Shaded values indicate exceedance of the CSL biological effects criteria.

[d] Survival in one replicate of the seawater control was greater than the estimated initial stocking density, therefore the mean is based on four replicates.

[e] See Table 1; 25 percent on an absolute basis, not relative to the reference sediment.

[f] See Table 1; 15 percent greater, on an absolute basis, than the reference sediment (i.e., 15 + 59.5 = 74.5 percent).

[g] See Table 1; 70 percent of the reference sediment biomass (i.e., 46.4 × 0.70 = 32.5 mg).

[h] See Table 1; 30 percent greater, on an absolute basis, than the reference sediment (i.e., 30 + 4 = 34 percent).

[i] See Table 1; 30 percent greater, on an absolute basis, than the reference sediment (i.e., 30 + 59.5 = 89.5 percent).

[j] See Table 1; 50 percent of the reference sediment biomass (i.e., 46.4 × 0.50 = 23.2 mg).

3.3.1 Amphipod Toxicity Test

For the amphipod toxicity test, there were no statistically significant differences in mortality between the site stations and reference station results. None of the stations exceeded either the SQS or CSL biological effects criteria (Table 7).

3.3.2 Bivalve Larvae Toxicity Test

For the bivalve larvae toxicity test, four stations (i.e., Stations W1-01, W1-02, W1-03, and W5-03; Figure 2) exhibited statistically significant differences in abnormality/mortality between the site stations and reference station results and exceeded SQS biological effects criteria (Table 7). However, only one station (Station W5-03) exceeded CSL biological effects criteria as well. Station W5-03 was the station with the highest TOC content (8.9 percent) of any of the stations, and it had a large amount of wood debris; both factors could have contributed to the response noted in the bivalve larvae toxicity test.

3.3.3 Juvenile Polychaete Toxicity Test

For the juvenile polychaete toxicity test, only one station (W5-01) demonstrated a statistically significant difference in biomass from the reference station biomass; the difference in biomass at that station was sufficient to exceed the SQS biological effects criteria, but not the CSL biological effects criteria (Table 7).

4. DISCUSSION

This section provides an analysis of whether sediment quality in the vicinity of the Weyerhaeuser facility's outfalls is such that any actions (e.g., authorization of sediment impact zones, initiation of sediment cleanup requirements) would be required by Ecology under the Washington State Sediment Management Standards.

The SQS and CSL criteria of the Washington State Sediment Management Standards are intended to be used as guidelines for assessing the quality of marine surface sediments in Puget Sound (i.e., those with interstitial salinities >25 ppt). The interstitial salinities of the site sediments sampled in this study ranged from 5.5 to 21 ppt (Table 5). The Washington State Sediment Management Standards do not include SQS and CSL criteria for sediments with these lower interstitial salinities; in the absence of such criteria, Ecology is likely to make comparisons with the marine SQS and CSL criteria to give a general indication of sediment quality.

4.1 COMPARISONS WITH SEDIMENT QUALITY STANDARDS

According to Ecology, exceedance of the SQS chemical criteria indicates that some minor adverse biological effects may be associated with these sediments. If there are exceedances of either the SQS chemical criteria or the SQS biological effects criteria in the vicinity of a permitted outfall and if those exceedances appear to be related to the discharge from that outfall, Ecology may consider the need for authorizing a sediment impact zone around the point of discharge. A sediment impact zone represents an area in which exceedances of the SQS criteria are authorized by Ecology within a wastewater discharge permit. A sediment impact zone is similar to a mixing zone in the water

column around a permitted discharge, in which exceedances of water quality standards are authorized by Ecology within a wastewater discharge permit.

4.1.1 Comparisons with SQS Chemical Criteria

On the basis of sediment chemistry, there appears to be no reason to consider the need for authorization of a sediment impact zone for any of the four permitted outfalls. The only exceedances of the SQS chemical criteria at any of the stations in the vicinity of these outfalls were for total PCBs at Station W2-01 and for 4-methylphenol at Station W5-03 (Table 6, Figure 2).

There is no reason to believe that the presence of total PCBs in the sediments at Station W2-01 is related to the permitted discharges from Outfalls WK002 or WK004 (Figure 2). Historically, Outfall WK002 discharged only noncontact cooling water and storm water runoff, while Outfall WK004 discharged backwash from the mill's water filtration system. Neither discharge would likely have contained PCBs. Currently, storm water continues to be discharged from both outfalls, and river water from the mill's water filtration system is still periodically discharged from Outfall WK004. The concentrations of total PCBs were low or undetected at the seven other stations along the south shoreline of the Snohomish River in front of the mill (Table 6, Figure 2).

There is also no reason to believe that the presence of 4-methylphenol in the sediments at Station W5-03 is related to the permitted discharge from Outfall WK005 (Figure 2). Outfall WK005 discharges surface runoff from the south side of Smith Island, including Weyerhaeuser's landfill. 4-Methylphenol was undetected at the other three stations in the vicinity of Outfall WK005, including Station W5-01, which is immediately adjacent to the point of discharge (Table 6, Figure 2). As indicated earlier, the presence of 4-methylphenol at Station W5-03 is more likely related to the large amount of wood debris in the sediments at that station, which appeared to be a result of log rafting in the area. The fact that the 4-methylphenol was also found in exceedance of the SQS criterion at

the local background station (ES-01; Figure 2), an area far removed from the Weyerhaeuser discharges but with considerable log rafting, supports this interpretation.

4.1.2 Comparisons with SQS Biological Effects Criteria

With regard to the potential need for a sediment impact zone, the results of the sediment toxicity tests are equivocal. For the amphipod test, there were no exceedances of the SQS biological effects criterion (Table 7). For the juvenile polychaete test, there was only one station (Station W5-01, Figure 2) that exceeded the biological effects criterion (Table 7), and that exceedance was very minor (i.e., to exceed the criterion, the test sediment had to have a polychaete biomass less than 32.5 mg; at Station W5-01, the polychaete biomass was 31.6 mg). For the bivalve larvae test, there were exceedances of the biological effects criterion at Stations W1-01, W1-02, W1-03, and W5-03 (Table 7, Figure 2).

The fact that there were no exceedances of the SQS biological effects criteria for any of the three toxicity tests at any of the stations along the south shoreline of the Snohomish River in front of the mill (Table 7, Figure 2) indicates that there should be no need for a sediment impact zone for Outfalls WK002 and WK004. The fact that there were no exceedances of the biological effects criteria at Station W2-01 overrides a determination of SQS exceedance based on sediment chemistry alone (see Section 4.1.1 above).

The relatively minor exceedance of the SQS biological effects criterion for the juvenile polychaete test at Station W5-01 (Table 7, Figure 2) did not appear to be associated with any chemical contamination, at least for chemicals for which there are SQS criteria (Table 6). Hence, while this biological effect could be associated with other chemicals potentially associated with the discharge from Outfall WK005, the biological effect appears to be highly localized because none of the other stations surrounding Outfall WK005 had such an effect (Table 7, Figure 2).

The exceedance of the SQS biological effects criterion for the bivalve larvae test at Station W5-03 (Table 7, Figure 2) could potentially be associated with the presence of 4-methylphenol in the sediments at that station. The SQS criterion for 4-methylphenol was established on the basis of significant effects in the bivalve larvae test always having been observed at concentrations of 4-methylphenol above 670 μg/kg dry weight (Barrick et al. 1988). It is also possible that the exceedance of the biological effects criterion at that station was a result of wood debris in the sediments at that station, other chemicals associated with the wood debris, the high TOC content of the sediment, or the high total sulfides concentration.

The fact that a consistent pattern of exceedances of the SQS chemical and biological effects criteria was not observed at the four stations off Outfall WK005, and the fact that there were no chemicals detected in the sediments that both were present in elevated concentrations and could be clearly linked to the discharge from the outfall suggest that there is no apparent justification for a sediment impact zone in the vicinity of this outfall.

The exceedances of the SQS biological effects criterion for the bivalve larvae test at Stations W1-01, W1-02, and W1-03 may suggest a possible association with historical discharges from Outfall WK001 (Table 7, Figure 2). However, there were no exceedances of the SQS chemical criteria at any of these stations (Table 6), and there were no significant effects in the other two sediment toxicity tests (Table 7). These three stations did have, however, the finest grain-size sediments of any collected in this study, three of the four highest TOC contents, and three of the five highest total sulfides concentrations (Table 5). While it is not known whether such factors could be responsible for the observed responses in the bivalve test, several points are worth mentioning. First, the sediment from reference Station HM-05 was also predominantly fine-grained (Table 5) and had a combined abnormality/mortality in the bivalve larvae test similar to those at Stations W1-01, W1-02, and W1-03 (Table 7). Second, among the toxicity test stations, those with the four highest total sulfides concentrations (Table 5) were also the only four stations to exhibit exceedances of either the SQS or CSL biological effects criteria in the bivalve larvae test (Table 7). Finally, the only bivalve larvae tests in which there were

detectable ammonia concentrations in the overlying water were those for Stations W1-02 and W1-03, which is consistent with the high total sulfides concentrations.

Hence, the bivalve larvae test results for the sediments from Stations W1-01, W1-02, and W1-03 may be associated with the fine grain size, high TOC content, and high total sulfides concentration of these sediments. The slough into which Outfall WK001 discharges likely represents a relatively quiescent, depositional environment. Therefore, the sediment conditions there may result from the settling of organic particulate matter transported to the slough with the currents, and not necessarily from the historical discharges from that outfall. The fact that there is no longer an ongoing discharge from Outfall WK001 (i.e., water is only discharged from that outfall relatively infrequently when excess storm water accumulates in the Smith Island treatment ponds) also suggests that there is no justification for a sediment impact zone associated with that outfall.

4.2 COMPARISONS WITH CLEANUP SCREENING LEVELS

According to Ecology, exceedance of the CSL chemical criteria indicates that there may be adverse biological effects associated with these sediments that are sufficient to necessitate consideration of the need for sediment cleanup. Similarly, exceedance of the CSL biological effects criteria may also result in a similar determination.

Ecology uses the CSL criteria to screen "statio Significantly Exceed. also ther they should be considered "station clusters of potentia luated for possible sediment cleanup. A "station cluster" is i it stations with similar chemical concentrations. Accordi Sediment Management Standards, Ecology may designate a "station cluster of potential concern" when the average concentration of one or more chemicals from three stations within a station cluster exceeds the CSL criteria. Such a designation may trigger the need for a hazard assessment, which potentially requires a much more detailed and costly sediment investigation.

For the purposes of this study, the site stations (Figure 2) are grouped into the following three clusters:

- One cluster in the vicinity of Outfall WK001, consisting of Stations W1-01, W1-02, W1-03, SS-01, SS-02, SS-03, SS-04, and SS-05

- One cluster in the vicinity of Outfalls WK002 and WK004, consisting of Stations W2-01, W2-02, W4-01, W4-02, W4-03, SR-01, SR-02, and SR-03

- One cluster in the vicinity of Outfall WK005, consisting of Stations W5-01, W5-02, W5-03, and W5-04.

4.2.1 Comparisons with CSL Chemical Criteria

There were no exceedances of CSL chemical criteria (Table 6) at any of the stations within the first or third station clusters. There was only a single station within the second station cluster that had any exceedances of the CSL chemical criteria (for 4-methylphenol at Station W5-03, Table 6).

Ecology's (1991) *Sediment Cleanup Standards User Manual* includes a worksheet for use in screening station clusters using chemical data. This worksheet was completed (Appendix D) for the second station cluster. The average of the three highest 4-methylphenol concentrations within the second station cluster was below the CSL criterion. Therefore, the second station cluster does not represent a "station cluster of potential concern," based on sediment chemistry.

4.2.2 Comparisons with CSL Biological Effects Criteria

There were no exceedances of CSL biological effects criteria (Table 7) at any of the stations within the first or second station clusters. There was only a single station within the third station cluster that had any exceedances of the CSL biological effects criteria (for the bivalve larvae test at Station W5-03; Table 7).

Ecology's (1991) *Sediment Cleanup Standards User Manual* also includes a worksheet for use in screening station clusters using biological data. For this worksheet, a station could fail the CSL biological criteria if two or more biological tests fail the SQS biological effects criteria, regardless of whether there were any exceedances of the CSL biological effects criteria at that station (see Table 1). Therefore, this worksheet was completed (Appendix D) both for the first station cluster (where there were exceedances of the SQS biological effects criteria at three stations) and for the third station cluster (where there was one exceedance of the SQS biological effects criteria and one exceedance of the CSL biological effects criteria). Because no station within the first station cluster had more than one biological test exceeding the SQS biological effects criteria, none of the stations exceeded the CSL criteria; therefore, this cluster is not a "station cluster of potential concern." Because only one station within the third station cluster exceeded the CSL biological effects criteria, the third station cluster also does not represent a "station cluster of potential concern."

5. CONCLUSIONS

Overall, this baseline sediment assessment found surface (0-10 cm) sediments in the vicinity of the Weyerhaeuser wastewater outfalls to have low concentrations of most chemical contaminants. The only chemicals found to exceed the SQS criteria of the Washington State Sediment Management Standards in the sediments at any of the stations in the vicinity of these outfalls were total PCBs and 4-methylphenol, each at a single station. The only chemical found to exceed the CSL criteria in the vicinity of these outfalls was 4-methylphenol at a single station.

Similarly, surface sediments were found to be generally nontoxic in three different sediment toxicity tests. Among the 36 toxicity tests completed (i.e., three toxicity tests at each of twelve stations in the vicinity of these outfalls), only five exceeded the SQS biological effects criteria and only one of these also exceeded the CSL biological effects criteria. There are indications that at least some of the exceedances of SQS and CSL biological effects criteria may be attributable to factors other than chemical contamination (i.e., wood debris, fine grain size, high TOC content, or high total sulfides concentration).

The sediment chemistry and biological effects data were evaluated under the provisions of the Sediment Source Control Standards (Part IV) of the Washington State Sediment Management Standards (Chapter 173-204 WAC). On the basis of that evaluation, there does not appear to be a need for authorization of a sediment impact zone for any of the four permitted outfalls at the Weyerhaeuser facility.

The sediment chemistry and biological effects data were also evaluated under the provisions of the Sediment Cleanup Standards (Part V) of the Washington State Sediment Management Standards (Chapter 173-204 WAC). On the basis of that evaluation, there

do not appear to be any "station clusters of potential concern" in the vicinity of any of these outfalls; therefore, there should be no need for a more detailed hazard assessment.

In conclusion, overall sediment quality in the vicinity of the Weyerhaeuser facility's outfalls appears to be good, and no further sediment-related action should be required by Ecology.

6. REFERENCES

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APPENDIX A

Station/Sample Log

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W101 DATE: 4/1/94 GEAR: Box core (by hand)

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	1430	None	NA	NA	NA	WE013	65246-65256	10 cm.	

TEXTURE: Cobble Gravel Sand (Silt) Clay

COLOR: Black (Brown Grey) Green

ODOR: (Normal) Sewage H_2S Petroleum None

COMMENTS:

Sample collected by hand (see protocol); station measured

No overlying water; sediment collected at low tide

Very soft sediment.

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W102 DATE: 3/29/94 GEAR: Box core

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm)	
1	1820	10	48 01.797	122° 12.065	28179.2	WE014	65107–	15in	
					42379.9		65117		

TEXTURE: Cobble Gravel (Sand) much finer than SSOL (Silt) a little silt (Clay) a little clay

COLOR: (Black) Brown (Grey) Green

ODOR: Normal Sewage (H_2S) Petroleum None

COMMENTS:

mid way between [X] on slough.

qp = 33½/69 = 0.485 = 51.4% fines

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W103 DATE: 3/29/94 GEAR: Box Core

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Coordinates Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm)	
1	1805	10	~~48°01.075N~~ 4°01.847N	~~122°12.228W~~ 122°12.080W	28179.6 ~~42380.0~~	WE015	65086 - 651	17.5 in	

TEXTURE: Cobble Gravel (Sand — much finer than sugar) (Silt — a little silt) (Clay — a little clay)

COLOR: (Black) Brown Grey (Green)

ODOR: Normal Sewage (H_2S) Petroleum None

sticky black mud

COMMENTS:

Radar: 640' from wall at south end of cut just inside mouth of outfall slough

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SS01 DATE: 3/29/94 GEAR: Box corer

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm) 24-9½	
1	1638	18	48 01.901N	122 11.927W	28179.9 42380.6	WE016	65061-65068	14.5 inch	

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

COMMENTS: 90' due west of large, orange, steel tug buoy.
740' due east of pilings on west edge of inlet leading to WK001.
Underway 1:55 pm. Eaton, Hogue, Sexton and Soukup.

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SS02 DATE: 3/29/94 GEAR: Box corer

Cast #	Time	Water Depth (ft)	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	17:02	17	48°01.873'N	122°R.054'W	281802 / 2380.1	WE017	65069-65076	13 in	

TEXTURE: Cobble Gravel (Sand) Silt Clay

COLOR: Black Brown (Grey) Green

ODOR: Normal Sewage H_2S Petroleum (None)

Wood debris in bottom of core; no wood in sample.

COMMENTS: due west of second large orange buoy.

gs = 66/69 = 0.95 = 4.3% fines

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SS03 DATE: 3/29 GEAR: Box Corer

Cast #	Time	Water Depth (ft)	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	17:25	18'	4801.875N	122° 12.228'	28180.8 42379.4	WE018	65080- 65087	14 in.	

TEXTURE: Cobble Gravel (Sand) coarser than SS02+SS01 Silt Clay

COLOR: Black Brown (Grey) Green

ODOR: Normal Sewage H_2S Petroleum (None)

COMMENTS:

Radar: 700' due west of pilings at west side of entrance to WK001

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: ***Weyerhaeuser*** STATION: SS04 DATE: 3/29/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude (Loran)	Sample No.	Tag No.		
1	1848	13	48° 01.822	122° 12.640	28181.5 / 42378.2	WE019	650086-650095	15 in	

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

COMMENTS: Radar: 2145' from pilings at west edge of cut (W Kood)

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: 5505 DATE: 3/30/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	19:40	14	48 01.75' N	122° 13.73'	28183.0 42376.1	5505	65170 – 65177	14.25 in.	

TEXTURE: Cobble Gravel (Sand) Silt Clay

COLOR: Black Brown (Grey) Green

ODOR: Normal Sewage H_2S Petroleum (None)

Smooth surface almost 100% sand.

COMMENTS:

1900 ft east of priest point = RADAR.

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W401 DATE: 3/31/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates		Loran	Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	1856	7.5	48°00.959N	122°11.400W	28169.0 42380.0	WF001	65205- 65212	20in	

TEXTURE:	Cobble	Gravel	(Sand)	Silt	(Clay) mix about 1/2 down 5-10cm
COLOR:	Black	Brown	Grey	Green	
ODOR:	Normal	Sewage	(H_2S) when dumped	Petroleum	None

COMMENTS:

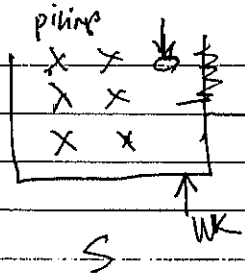

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W402 DATE: 3/31/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm) in	
1	18:25	14	48°01.00/N	122°11.40/	28169.5 42380.1	WE002	65189–65196	15.5"	
	(1835) dup time					WE025 DUP=	65197–65204	[redacted]	

TEXTURE: Cobble Gravel (Sand) Silt (Clay) May at deeper 5-10 cm

COLOR: (Black) clay Brown (Grey) sand Green

ODOR: Normal Sewage H_2S (Petroleum) None

heavy diesel smell

COMMENTS: Field Dup. = ~~WE005~~ WE025

Dup sample taken from same composite.

just of east corner of mill

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W407 DATE: 3/31/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates Latitude	Longitude	Altitude	Sample No.	Tag No.	Penetration Depth (cm)	
1	17:37	11	48°01.037N	122°11.527W		WE003	65178–		Rejected (0.1' she
2	17:45	12	48°01.025N	122°11.534W			65188		Rejected - (Empty)
3	17:50	12	48°01.070N	122°11.524W					Rejected (Notenou
4	17:58	12	48°01.048N	122°11.544W					Rejected (Poor seo
5	18:04	12	48°01.055N	122°11.524W	28170.4 42379.8			8 inches	

TEXTURE: Cobble Gravel (Sand) Silt Clay

COLOR: Black Brown (Grey) Green

ODOR: Normal Sewage H_2S Petroleum (None)

Radar: ~~330'~~ ± 330' from pilings (dolphins) at SSO2

COMMENTS:

Underway @ 5:00 pm Eaton, Hogue, Sexton, Soukup. Ran equip. rinsate blanks for ABNs/Pest/PCBs, metals & PCDD/PCDF at 1720.

* Note - Cast 1, position 21, rejected because of wood debris. Sheen observed.

Cast #2 - Empty.

Cast #3 - more sediment less wood, most of sample washed away

Cast #4 (0160) from pilings at entrance to Outfall just west of station (rejected)

#5 0.05' from piling (as described above)

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W201 DATE: 2/20/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	RADAR
			Latitude	Longitude	Altitude	Sample No.	Tag No.		
1	1550	9.1	~~48° 01.059'N~~ 01.046'N	~~122° 11.611'W~~ 11.633'W	28171.1 42379.5	WE004	~~65031-65052~~ ~~65031-65038~~ 65031-65041	26 1/2 cm	

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

Very uniform surface.

COMMENTS:

15' from the face of the dock off the outfall pipe.

39-40% fines.

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

#1 CRUISE: *Weyerhaeuser* STATION: W202 DATE: 3/28/94 GEAR: Box core

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Coordinates Longitude	Loran TD's (~~Altitude~~)	Sample No.	Tag No.	Penetration Depth (~~cm~~)	Radar
1	1320	9.7	48° 01.78' N	122° 11.639' W	28171.2 / 42379.6	WE005	65001- / 65011	10.75"	.024 nm (150') off doc

TEXTURE: Cobble Gravel **(Sand)** Silt Clay

COLOR: Black Brown **(Grey)** Green

ODOR: Normal Sewage H_2S Petroleum **(None)**

uniform distribution of grain size; a little wood debris

COMMENTS:

0830 - Health & Safety Briefing with Char Mann, Jane Sexton, Alan Saukup, & Charlie Eaton, Hoy
1000 - w/w c Hoyne, Sexton, Saukup, Eaton. Clear, no wind

Approx. 150' offshore from Station W201 (outfall WK002)

63 ml sed = 8.7 % fines.
69 0.913

PHOTO: Roll ______ No: ______

INITIALS: ______

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SR01 DATE: 3/28/94 GEAR: Box Core

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Longitude	Loran Altitude	Sample Sample No.	Tag No.	Penetration Depth (cm)	RADARK
1	1628	14	48°01.059'N	122°11.611'W	28171.6 42379.2	WE007	65042-65052	15½cm	NA
			~~01.078~~	~~11.639~~					
			01.087	11.765					

TEXTURE: Cobble Gravel (Sand) Silt Clay

COLOR: Black Brown (Grey) Green

ODOR: Normal Sewage H_2S Petroleum (None)

surface slanted; intact, no disturbance

COMMENTS:

in about 15' from pier corner

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SR02 DATE: 3/28/94 GEAR: Box core

Cast #	Time	Water Depth (ft)	Coordinates (Loran TD's) Latitude	Longitude	Altitude	Sample No.	Tag No.	Penetration Depth (cm)	Radar Ranges
Rejected→ 1	1405	11				WE006	65012-	11 inches	Rejected 1st cast
							65019		
2	1415	11	48°01.67'N	122° 11.732'W	28171.6 42379.3				.024 nm
			~~01.087~~	~~11.765~~					
			01.098	11.760					

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

Lots of wood debris; surface not smooth, but undisturbed.

COMMENTS:

Log debris and cable in spade; unable to get sample on 1st cast.

just off corner west of mill; approx 150' North of station SR01

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: SR03 DATE: 3/20/94 GEAR: Box core

Cast #	Time	Water Depth (ft)	Coordinates Latitude	Longitude	Altitude (Loran)	Sample No.	Tag No.	Penetration Depth (cm)	Radar
rejected 1	5101710	15				WE008	65053-65060	23.4 cm	
rejected 2	1719	15							
3	1727	14	48° 01.123'N	122° 12.021'W	28173.2 42378.5				.222nm from ~~NW corner of~~ Weyerhaeuser

TEXTURE: Cobble Gravel (Sand) Silt (Clay) little mixed in

COLOR: (Black) Brown Grey (Green)

ODOR: Normal Sewage H_2S Petroleum (None)

A little wood debris in cast #3.

COMMENTS:

First cast = nothing in box - cover lit wood debris.
Second cast = rejected; not enough sed.; no water, large wood debris is sticking out of bottom of box.
Third cast = moved a little closer in towards shore. just inshore south of double dolfins.

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W501 DATE: 4/1/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude (Loran)	Sample No.	Tag No.		
1	0637am	9.0	48°01.236N	122°11.672W	28172.2 / 42380.2	WE011	65224–65234	10 inches	

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

COMMENTS:

WK005

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: WS02 DATE: 4/1/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Loran Altitude	Sample No.	Tag No.		
1	6:19am	11	48°01.205N	122°11.610W	28171.9 42380.1	WE010	65213-65223	16.5 inches	

TEXTURE: Cobble Gravel Sand Silt Clay

tricolor mix

COLOR: Black Brown Grey Green

ODOR: Normal Sewage H_2S Petroleum None

oil spot on sediment

COMMENTS: 250' east of WK005

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: W503 DATE: 2/28/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm)	RADAR
1	1450	14	48°01.151'N	122° 11.649'W	28172.1 42379.7	WE009	65020	10.75 inches	NA
			01.183	11.658			65030		

TEXTURE: Cobble Gravel Sand Silt Clay

COLOR: (Black) Brown Grey Green

ODOR: Normal Sewage (H_2S) ! Petroleum None

Tons of wood debris; approx. 80% wood debris; oil drops on surface

COMMENTS:

Station located directly off outfall WK005 between 2nd & 3rd row of pilings see figure

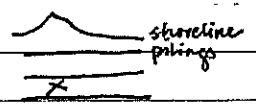

photo taken of sample.

PHOTO: Roll _____ No: _____ INITIALS: _____

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: WS04 DATE: 4/1/94 GEAR: Box Core

Cast #	Time	Water Depth ( )	Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (cm)	
1	07:01	10	48°01.226N	122°11.716W		WE012	65235 -		Rejected
2	07:10	10	48°01.230N	122°11.779W			65245		Rejected
3	07:16	11	48°01.248N	122°11.737W					Rejected
4	07:21	11	48°01.240	122°11.734W	28172.8 42379.6			7 inches	

TEXTURE:	Cobble	Gravel	Sand	Silt (even mix)	Clay
COLOR:	Black	Brown	Grey (Dark)		Green
ODOR:	Normal	Sewage	H_2S	Petroleum	None

COMMENTS: approx 250' west of WK005
Adjacent to log boom
Cast 1 - rejected, loss of seal, not enough sample.
Cast 2 A/A.
Cast 3 A/A.

PHOTO: Roll _____ No: _____ INITIALS: _____

FF 0192

PTI ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: ES01 DATE: 3/30/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates Latitude	Longitude	Altitude	Sample No.	Tag No.	Penetration Depth (cm)	
rejected> 1	18:55	16 Ft	48° 02.611 N	122° 12.755 W		WE021	65159		
(GOOD) 2	19:03	15	48 02.63 N	122 12.753 W			65169	5.5 inches	

TEXTURE: Cobble Gravel (Sand) Silt Clay

COLOR: Black Brown (Grey) DK. Green

ODOR: Normal Sewage (H_2S) slight Petroleum (None)

Lg. Wood fragments sticking out from bottom of box; no wood in sample.

COMMENTS:

Approximately 1050 ft from dolfins (approx every 100 ft there were dolfins)

1st cast rejected; debris.

gs = 43/64 =

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: HM03 DATE: 3/30/94 GEAR: Box Core
Ref Area #1

Cast #	Time	Water Depth (124')	GPS Coordinates Latitude	Longitude	Loran Altitude	Sample No.	Tag No.	Penetration Depth (~~cm~~) IN	
1	13:34	124'	48°06.186'	122°33.821	28299.0 42320.3	WE022	65118-65128	10.25"	

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

COMMENTS: North, mouth of Holmes Harbor

Underway ≥1100 Hogue, Eaton, Sorkup, Sexton

gs: 62/69 = 0.898 = 10.1% fines.

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

PTI
ENVIRONMENTAL SERVICES

STATION/SAMPLE LOG

CRUISE: *Weyerhaeuser* STATION: HM05 Ref Area #2 DATE: 3/30/94 GEAR: Box core

Cast #	Time	Water Depth ( )	Coordinates			Sample		Penetration Depth (cm)	
			Latitude	Longitude	Altitude (Corrs)	Sample No.	Tag No.		
1	14:35	94	48°01.840N	122°31.149W	28250.8 ft 2319.6	WE023	65129-65139	18 inches	

TEXTURE: Cobble Gravel Sand (Silt) (Clay) a little clay

COLOR: Black (Brown Grey) Green

ODOR: Normal Sewage (H_2S) Petroleum None

Tube worms on surface

COMMENTS: South end of Holmes Harbor

gs = 24/69 = 35% 0.34 = 66% fine

PHOTO: Roll _____ No: _____

INITIALS: _____

FF 0192

APPENDIX B

Chain-of-Custody Records

Weyerhaeuser Laboratory

PTI
ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2899
Page 1 of 4

Project: (Name and Number) EVERETT C646-11-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-643-9503
Ship Samples to: Weyerhaeuser Lab.
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	AENs/Pest/PCBs	PCDD/PCDF	Total sulfides, TOC, metals	Grainsize			Extra Container	Archive	Remarks
WE005	65001	3/28	1320				✓				G	✓								500 mL.
WE005	65002	3/28	1320				✓				G		✓							250 mL.
WE005	65003	3/28	1320				✓				G			✓						250 mL.
WE005	65004	3/28	1320				✓				G				✓					500 mL.
WE005	65005	3/28	1320				✓				G								✓	500 mL.
WE005	65006	3/28	1320				✓				G								✓	250 mL.
WE005	65007	3/28	1320				✓				G								✓	250 mL.
WE005	65008	3/28	1320				✓				G								✓	500 mL.
WE006	65012	3/28	1415				✓				G	✓								500 mL.
WE006	65013	3/28	1415				✓				G		✓							250 mL.
WE006	65014	3/28	1415				✓				G			✓						250 mL.
WE006	65015	3/28	1415				✓				G				✓					500 mL.
WE006	65016	3/28	1415				✓				G								✓	500 mL.
WE006	65017	3/28	1415				✓				G								✓	250 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane Sexton (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by Mobile Lab for Field Analysis: ______ (Signature) Date/Time ______

Received for Lab by: ______ (Signature) Date/Time ______

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2900

Project (Name and Number): EVERETT 545-61-01

Samplers: (Signature) JTI

Sampling Contact: Jane Sexton

Phone: 206-543-9503

Ship Samples to: Weyerhaeuser Lab

Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested						Extra Container	Archive	Remarks
												AVS/SEM/TOC	TOC/PSDDA	Total Sulfides, TOC, Metals	Grain Size					
WE006	65016	3/26	1415				✓				G								✓	250 mL.
WE006	65019	3/26	1415				✓				G								✓	500 mL.
WE009	65020	3/28	1455				✓				G	✓								500 mL.
WE009	65021	3/28	1455				✓				G		✓							250 mL.
WE009	65022	3/28	1450				✓				G			✓						250 mL.
WE009	65023	3/28	1450				✓				G				✓					500 mL.
WE009	65024	3/28	1455				✓				G								✓	500 mL.
WE009	65025	3/28	1455				✓				G								✓	250 mL.
WE009	65026	3/28	1450				✓				G								✓	250 mL.
WE009	65027	3/28	1450				✓				G								✓	500 mL.
WE004	65031	3/28	1558				✓				G	✓								500 mL.
WE004	65032	3/28	1558				✓				G		✓							250 mL.
WE004	65033	3/28	1558				✓				G			✓	✓					250 mL.
WE004	65034	3/28	1558				✓				G				✓					500 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2902

Project: (Name and Number) EVERETT CE45-01-01

Samplers: (Signature) ITI

Sampling Contact: Jane Sexton
Phone: 201-643-9502
Ship Samples to: Weyerhaeuser Lab.
Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: MEK/TPH/HCBs	PCDD/PCDF	Total Sulfides TOC, Metals	Grain Size			Extra Container	Archive	Remarks
WE004	65035	3/28	1555				✓				G								✓	500 mL.
WE004	65036	3/28	1558				✓				G								✓	250 mL.
WE004	65037	3/28	1558				✓				G								✓	250 mL.
WE004	65038	3/28	1558				✓				G								✓	500 mL.
WE007	65042	3/28	1628				✓				G	✓								500 mL.
WE007	65043	3/28	1628				✓				G		✓							250 mL.
WE007	65044	3/28	1628				✓				G			✓						250 mL.
WE007	65045	3/28	1628				✓				G				✓					500 mL.
WE007	65046	3/28	1628				✓				G								✓	500 mL.
WE007	65047	3/28	1628				✓				G								✓	250 mL.
WE007	65048	3/28	1628				✓				G								✓	250 mL.
WE007	65049	3/28	1628				✓				G								✓	500 mL.
WE005	65052	3/28	1727				✓				G	✓								500 mL.
WE008	65054	3/28	1727				✓				G		✓							250 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)
Relinquished by: (Signature)
Relinquished by: (Signature)

Received by: (Signature) Date/Time
Received by: (Signature) Date/Time
Received by Mobile Lab for Field Analysis: (Signature) Date/Time
Received for Lab by: (Signature) Date/Time

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PTI
ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2903

Page 4 of 4

Project: (Name and Number) EVERETT C545-01-01

Samplers: (Signature) III

Sampling Contact: Jane Sexton

Phone: 206-643-9803

Ship Samples to: Weyerhaeuser Lab

Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	ABNs/Pest/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grain size			Extra Container	Archive	Remarks
WE008	65055	3/28	1727				✓				G			✓						250 mL.
WE008	65056	3/28	1727				✓				G				✓					500 mL.
WE008	65057	3/28	1727				✓				G								✓	500 mL.
WE008	65058	3/28	1727				✓				G								✓	250 mL.
WE008	65059	3/28	1727				✓				G								✓	250 mL.
WE008	65060	3/28	1727				✓				G								✓	500 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number) EVERETT C645-01-01

Samplers: (Signature) PTI

Sampling Contact: JANE SEXTON
Phone: 206-643-9803
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	AE NE/Pest/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grain size			Extra Container	Archive	Remarks
WE016	65061	3/29	1138				✓				G	✓								500 mL.
WE016	65062	3/29	1138				✓				G		✓							250 mL.
WE016	65063	3/29	1138				✓				G			✓						250 mL.
WE016	65064	3/29	1138				✓				G				✓					500 mL.
WE016	65065	3/29	1138				✓				G								✓	500 mL.
WE016	65066	3/29	1138				✓				G								✓	250 mL.
WE016	65067	3/29	1138				✓				G								✓	250 mL.
WE016	65068	3/29	1138				✓				G								✓	500 mL.
WE017	65069	3/29	1702				✓				G	✓								500 mL.
WE017	65070	3/29	1702				✓				G		✓							250 mL.
WE017	65071	3/29	1702				✓				G			✓						250 mL.
WE017	65072	3/29	1702				✓				G				✓					500 mL.
WE017	65073	3/29	1702				✓				G								✓	~~500 mL~~. 500 mL.
WE017	65074	3/29	1702				✓				G								✓	250 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane Sexton (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by Mobile Lab for Field Analysis: ______ (Signature) Date/Time ______

Received for Lab by: ______ (Signature) Date/Time ______

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2907

Project: (Name and Number) EVERETT CE45-61-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-143-9803

Ship Samples to: Weyerhaeuser Lab.

Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: AEN-Pest/PCB	PCDD/PCDF	TEH equivalents, TEC, metals	Grain size			Extra Container	Archive	Remarks
WE017	L50715	3/29	1702				✓				G								✓	250 mL.
WE017	L5L76	3/29	1702				✓				G								✓	500 mL.
WE018	L5050	3/29	1725				✓				G	✓								500 mL.
WE018	L5L81	3/29	1725				✓				G		✓							250 mL.
WE018	L5L82	3/29	1725				✓				G			✓						250 mL.
WE018	L5083	3/29	1725				✓				G				✓					500 mL.
WE018	L5L84	3/29	1735				✓				G								✓	500 mL.
WE018	L5L85	3/29	1725				✓				G								✓	250 mL.
WE018	L5086	3/29	1725				✓				G								✓	250 mL.
WE018	L5L87	3/29	1725				✓				G								✓	500 mL.
WE019	L5L88	3/29	1848				✓				G	✓								500 mL.
WE019	L5L89	3/29	1848				✓				G		✓							250 mL.
WE019	L5090	3/29	1848				✓				G			✓						250 mL.
WE019	L5L91	3/29	1848				✓				G				✓					500 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)

Relinquished by: (Signature)

Relinquished by: (Signature)

Received by: (Signature) Date/Time

Received by: (Signature) Date/Time

Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number) CVERE II C640-11-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-643-9803
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	[illegible]	[illegible]	Total sulfides, TOC, metals	Grainsize			Extra Container	Archive	Remarks
WE019	65092	3/29	1848				✓				G								✓	500 mL
WE019	65093	3/29	1848				✓				G								✓	250 mL
WE019	65094	3/29	1848				✓				G								✓	250 mL
WE019	65095	3/29	1848				✓				G								✓	500 mL
WE015	65096	3/29	1815				✓				G	✓								500 mL
WE015	65097	3/29	1805				✓				G		✓							250 mL
WE015	65098	3/29	1815				✓				G			✓						250 mL
WE015	65099	3/29	1815				✓				G				✓					500 mL
WE015	65100	3/29	1805				✓				G								✓	500 mL
WE015	65101	3/29	1805				✓				G								✓	250 mL
WE015	65102	3/29	1805				✓				G								✓	250 mL
WE015	65103	3/29	1815				✓				G								✓	500 mL
WE014	65107	3/29	1820				✓				G	✓								500 mL
WE014	65108	3/29	1820				✓				G		✓							250 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt: ____

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ____

Relinquished by: Jane Sexton (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by Mobile Lab for Field Analysis: ____ (Signature) Date/Time ____

Received for Lab by: ____ (Signature) Date/Time ____

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number)

Samplers: *(Signature)*

Sampling Contact: Jane Sexton
Phone: 206-642-9563
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	NENC/Pest/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grainsize			Extra Container	Archive	Remarks
WE014	65109	3/29	1820				✓				G			✓						250 mL
WE014	65110	3/29	1820				✓				G				✓					500 mL
WE014	65111	3/29	1820				✓				G								✓	500 mL
WE014	65112	3/29	1820				✓				G								✓	250 mL
WE014	65113	3/29	1820				✓				G								✓	250 mL
WE014	65114	3/29	1820				✓				G								✓	500 mL

Method of Shipment:

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton *(Signature)* Received by: *(Signature)* Date/Time

Relinquished by: *(Signature)* Received by: *(Signature)* Date/Time

Relinquished by: *(Signature)* Received by Mobile Lab for Field Analysis: *(Signature)* Date/Time

Received for Lab by: *(Signature)* Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2910

Page 1 of 4

Project: (Name and Number) [illegible]

Samplers: (Signature) ITL

Sampling Contact: Jane Sexton
Phone: 206-643-9803
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	ABN/Pest/PCBs	PCDD/PCDF	Total sulfides, TOC, metals	Grain size			Extra Container	Archive	Remarks
WE022	65118	3/20	1334				✓				G	✓								500 mL.
WE022	65119	3/20	1334				✓				G		✓							250 mL.
WE022	65120	3/20	1334				✓				G			✓						250 mL.
WE022	65121	3/20	1334				✓				G				✓					500 mL.
WE022	65122	3/20	1334				✓				G								✓	500 mL.
WE022	65123	3/20	1334				✓				G								✓	250 mL.
WE022	65124	3/20	1334				✓				G								✓	250 mL.
WE022	65125	3/20	1334				✓				G								✓	500 mL.
WE023	65129	3/20	1435									✓								500 mL.
WE023	65130	3/20	1435										✓							250 mL.
WE023	65131	3/20	1435											✓						250 mL.
WE023	65132	3/20	1435												✓					500 mL.
WE023	65133	3/20	1435																✓	500 mL.
WE023	65134	3/20	1435																✓	250 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane Sexton (Signature) — Received by: ______ (Signature) — Date/Time ______

Relinquished by: ______ (Signature) — Received by: ______ (Signature) — Date/Time ______

Relinquished by: ______ (Signature) — Received by Mobile Lab for Field Analysis: ______ (Signature) — Date/Time ______

Received for Lab by: ______ (Signature) — Date/Time ______

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PTI
ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2911

Page 2 of 4

Project: (Name and Number) Everett C545-01-01

Samplers: (Signature) ttI

Sampling Contact: Jane Sexton

Phone: 206-643-9803

Ship Samples to: Weyerhaeuser Lab.

Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other (details water)	Other	Concentration (L M H)	Composite or Grab	ABN/Pest/PCB	PCDD/PCDF	Total Sulfides, TOC, metals		Metals only		Extra Container	Archive	Remarks
WE023	L5135	3/30	1435				✓				G								✓	250 mL.
WE023	L5136	3/30	1435				✓				G								✓	500 mL.
WE024	L5140	3/30	1614				✓					✓								500 mL.
WE024	L5141	3/30	1614				✓						✓							250 mL
WE024	L5142	3/30	1614				✓							✓						250 mL
WE024	L5143	3/30	1614				✓								✓					500 mL
WE024	L5144	3/30	1614				✓												✓	500 mL
WE024	L5145	3/30	1614				✓												✓	250 mL
WE024	L5146	3/30	1614				✓												✓	250 mL.
WE024	L5147	3/30	1614				✓												✓	500 mL
~~Eq. Rinsate~~	~~L5151~~	~~3/30~~						✓				✓								~~1 of 2~~ JS 3/30/94
~~Eq. Rinsate~~	~~L5152~~	~~3/30~~						✓				✓								~~2 of 2~~ JS 3/30/94
~~Eq. Rinsate~~	~~L5153~~	~~3/30~~						✓								✓				~~1 of 4~~ JS 3/30/94
~~Eq. Rinsate~~	~~L5154~~	~~3/30~~						✓								✓				~~2 of 4~~ JS 3/30/94

Method of Shipment: Courier

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane Sexton (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by Mobile Lab for Field Analysis: ______ (Signature) Date/Time ______

Received for Lab by: ______ (Signature) Date/Time ______

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2904

Project (Name and Number): EVERETT 1545-01-01

Samplers: (Signature) TTI

Sampling Contact: Jane Sexton

Phone: 206-642-9502

Ship Samples to: Weyerhaeuser Lab

Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other (Acidified Water)	Other	Concentration (L M H)	Composite or Grab	ABN/BNA/PCB	PCDD/PCDF	Total Sulfides/Reg. Metals	Metals only		Extra Container	Archive	Remarks
~~Eq. Blank~~	~~65155~~	~~3/20~~						✓							✓				~~2 of 4~~ RS 3/20/94
~~Eq. Blank~~	~~65156~~	~~3/20~~						✓							✓				~~4 of 4~~ RS 3/20/94
~~Eq. Blank~~	~~65157~~	~~3/20~~						✓					✓						~~1 of 2~~ RS 3/30/94
~~Eq. Blank~~	~~65158~~	~~3/20~~						✓					✓						~~2 of 2~~ RS 3/30/94
WE021	65159	3/20	1902				✓					✓							500 mL.
WE021	65160	3/20	1902				✓						✓						250 mL.
WE021	65161	3/30	1903				✓							✓					250 mL.
WE021	65162	3/20	1903				✓								✓				500 mL.
WE021	65163	3/20	1903				✓											✓	500 mL.
WE021	65164	3/20	1903				✓											✓	250 mL.
WE021	65165	3/20	1903				✓											✓	250 mL.
WE021	65166	3/20	1903				✓											✓	500 mL.
WE020	65170	3/20	1940				✓					✓							500 mL
WE020	65171	3/20	1940				✓						✓						250 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2913

Project: (Name and Number) EVERETT C045-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-643-9803
Ship Samples to:
Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: NWTPH/ICE	PCBD/PCDF	Total Sulfides TCLP Metals	Grain Size			Extra Container	Archive	Remarks
WE020	65172	3/30	1140				✓				G			✓						250 mL
WE020	65173	3/30	1940				✓				G				✓					500 mL
WE020	65174	3/30	1940				✓				G								✓	500 mL
WE020	65175	3/30	1940				✓				G								✓	250 mL
WE020	65176	3/30	1940				✓				G								✓	250 mL
WE020	65177	3/30	1940				✓				G								✓	500 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)

Relinquished by: (Signature)

Relinquished by: (Signature)

Received by: (Signature) Date/Time

Received by: (Signature) Date/Time

Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number) EVERETT C545·01·11

Samplers: (Signature) ITI

Sampling Contact: Jane Sexton
Phone: 206·642·9502
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other (distilled water)	Other	Concentration (L M H)	Composite or Grab	AEN/Pest/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grainsize		Metals only	Extra Container	Archive	Remarks
EQ·Rinsate	65151	3/31	1720					✓				✓								1 of 2
EQ·Rinsate	65152	3/31	1720					✓				✓								2 of 2
EQ·Rinsate	65153	3/31	1720					✓									✓			1 of 4
EQ·Rinsate	65154	3/31	1720					✓									✓			2 of 4
EQ·Rinsate	65155	3/31	1720					✓									✓			3 of 4
EQ·Rinsate	65156	3/31	1720					✓									✓			4 of 4
EQ·Rinsate	65157	3/31	1720					✓					✓							1 of 2
EQ·Rinsate	65158	3/31	1720					✓					✓							2 of 2
WE003	65178	3/31	1804				✓					✓								500 mL
WE003	65179	3/31	1804				✓						✓							250 mL
WE003	65180	3/31	1804				✓							✓						250 mL
WE003	65181	3/31	1804				✓								✓					500 mL
WE003	65182	3/31	1804				✓												✓	500 mL
WE003	65183	3/31	1804				✓												✓	250 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2915

Project: (Name and Number) EVERETT C545-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-643-9503
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: NEN/PAH/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grain size			Extra Container	Archive	Remarks
WE003	65184	3/31	1604				✓				G								✓	250 mL
WE003	65185	3/31	1604				✓				G								✓	500 mL
WE002	65189	3/31	1625				✓				G	✓								500 mL
WE002	65190	3/31	1625				✓				G		✓							250 mL
WE002	65191	3/31	1625				✓				G			✓						250 mL
WE002	65192	3/31	1625				✓				G				✓					500 mL
WE002	65193	3/31	1625				✓				G								✓	500 mL
WE002	65194	3/31	1625				✓				G								✓	250 mL
WE002	65195	3/31	1625				✓				G								✓	250 mL
WE002	65196	3/31	1625				✓				G								✓	500 mL
WE025	65197	3/31	1625				✓				G	✓								500 mL
WE025	65198	3/31	1625				✓				G		✓							250 mL
WE025	65199	3/31	1625				✓				G			✓						250 mL
WE025	65200	3/31	1625				✓				G				✓					500 mL

Remarks

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by: (Signature) Date/Time

Relinquished by: (Signature) Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2917

Project: (Name and Number) EVERETT C545-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-643-9803

Ship Samples to: Weyerhaeuser Lab.

Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: MEN/Pest/PCB	PCDD/PCDF	Total Sulfides TOC, particle size	Grain size			Extra Container	Archive	Remarks
WE025	65201	3/31	1835				✓				G								✓	500 mL
WE025	65202	3/31	1835				✓				G								✓	250 mL
WE025	65203	3/31	1835				✓				G								✓	250 mL
WE025	65204	3/31	1835				✓				G								✓	500 mL
WE001	65205	3/31	1856				✓				G	✓								500 mL
WE001	65206	3/31	1856				✓				G		✓							250 mL
WE001	65207	3/31	1856				✓				G			✓						250 mL
WE001	65208	3/31	1856				✓				G				✓					500 mL
WE001	65209	3/31	1856				✓				G								✓	500 mL
WE001	65210	3/31	1856				✓				G								✓	250 mL
WE001	65211	3/31	1856				✓				G								✓	250 mL
WE001	65212	3/31	1856				✓				G								✓	500 mL
WE010	65213	4/1	0619				✓				G	✓								500 mL
WE010	65214	4/1	0619				✓				G		✓							250 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)

Relinquished by: (Signature)

Relinquished by: (Signature)

Received by: (Signature) Date/Time

Received by: (Signature) Date/Time

Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI
ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

Project: (Name and Number) EVERETT C645-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-643-9503

Ship Samples to: Weyerhaeuser Lab

Attn:

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	ABN/PEST/PCB	PCDD/PCDF	Total sulfides, TOC, metals	Grainsize			Extra Container	Archive	Remarks
WE010	65215	4/1	0619				✓				G	[illegible]		✓						250 mL
WE010	65216	4/1	0619				✓				G				✓					500 mL
WE010	65217	4/1	0619				✓				G								✓	500 mL
WE010	65218	4/1	0619				✓				G								✓	250 mL
WE010	65219	4/1	0619				✓				G								✓	250 mL
WE010	65220	4/1	0619				✓				G								✓	500 mL
WE011	65224	4/1	0627				✓				G	✓								500 mL
WE011	65225	4/1	0637				✓				G		✓							250 mL
WE011	65226	4/1	0637				✓				G			✓						250 mL
WE011	65227	4/1	0637				✓				G				✓					500 mL
WE011	65228	4/1	0637				✓				G								✓	500 mL
WE011	65229	4/1	0637				✓				G								✓	250 mL.
WE011	65230	4/1	0637				✓				G								✓	250 mL.
WE011	65231	4/1	0637				✓				G								✓	500 mL.

Method of Shipment: Courier

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane Sexton (Signature) — Received by: ______ (Signature) — Date/Time ______

Relinquished by: ______ (Signature) — Received by: ______ (Signature) — Date/Time ______

Relinquished by: ______ (Signature) — Received by Mobile Lab for Field Analysis: ______ (Signature) — Date/Time ______

Received for Lab by: ______ (Signature) — Date/Time ______

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2919

Project: (Name and Number) EVCI-CTT C545-11-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-642-9803
Ship Samples to: Weyerhaeuser Lab
Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: MBN/PEST/PCB	PCDD/PCDF	Total Sulfides/ TOC, Metals	Grain size			Extra Container	Archive	Remarks
WEC12	~~EL~~ 65235	4/1	0721				✓				G	✓								500 mL
WEC12	65236	4/1	0721				✓				G		✓							250 mL
WEC12	65237	4/1	0721				✓				G			✓						250 mL
WEC12	65238	4/1	0721				✓				G				✓					500 mL
WEC12	65239	4/1	0721				✓				G								✓	500 mL
WEC12	65240	4/1	0721				✓				G								✓	250 mL
WEC12	65241	4/1	0721				✓				G								✓	250 mL
WEC12	65242	4/1	0721				✓				G								✓	500 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)

Relinquished by: (Signature)

Relinquished by: (Signature)

Received by: (Signature) Date/Time

Received by: (Signature) Date/Time

Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2921

Project: (Name and Number) EVERETT C545-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-643-9503

Ship Samples to: Weyerhaeuser Lab.

Attn:

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: AMN/PEST/PCB	FEED/FEOF	TOC/SULFIDES/TCLP/METALS	GRAIN SIZE			Extra Container	Archive	Remarks
WED12	65246	4/1	1430				✓				G	✓								500 mL
WED12	65247	4/1	1430				✓				G		✓							250 mL
WED12	65248	4/1	1430				✓				G			✓						250 mL
WED12	65249	4/1	1430				✓				G				✓					500 mL
WED12	65250	4/1	1430				✓				G								✓	500 mL
WED12	65251	4/1	1430				✓				G								✓	250 mL
WED12	65252	4/1	1430				✓				G								✓	250 mL
WED12	65253	4/1	1430				✓				G								✓	500 mL

Method of Shipment: Courier

Condition of Samples Upon Receipt:

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by:

Relinquished by: Jane Sexton (Signature)

Relinquished by: (Signature)

Relinquished by: (Signature)

Received by: (Signature) Date/Time

Received by: (Signature) Date/Time

Received by Mobile Lab for Field Analysis: (Signature) Date/Time

Received for Lab by: (Signature) Date/Time

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Northwestern Aquatic Sciences

PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2901

Page 1 of 1

Project: (Name and Number) EVERETT CE45-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton
Phone: 206-643-9803
Ship Samples to: NAZ
Attn: Dick Caldwell

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	BIOASSAYS PCL SCW						Extra Container	Archive	Remarks
WE005	65009	3/28	1220				✓				G	✓								1 of 3
WE005	65010	3/28	1220				✓				G	✓								2 of 3
WE005	65011	3/28	1220				✓				G	✓								3 of 3
WE009	65028	3/28	1450				✓				G	✓								1 of 3
WE009	65029	3/28	1450				✓				G	✓								2 of 3.
WE009	65030	3/28	1450				✓				G	✓								3 of 3.
WE004	65039	3/28	1558				✓				G	✓								1 of 3.
WE004	65040	3/28	1558				✓				G	✓								2 of 3.
WE004	65041	3/28	1558				✓				G	✓								3 of 3.
WE007	65050	3/28	1628				✓				G	✓								1 of 3.
WE007	65051	3/28	1628				✓				G	✓								2 of 3.
WE007	65052	3/28	1628				✓				G	✓								3 of 3.

Method of Shipment: Express Overnight

Condition of Samples Upon Receipt: ______

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ______

Relinquished by: Jane E. Sexton (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by: ______ (Signature) Date/Time ______

Relinquished by: ______ (Signature) Received by Mobile Lab for Field Analysis: ______ (Signature) Date/Time ______

Received for Lab by: ______ (Signature) Date/Time ______

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2906

Project: (Name and Number) EVERETT C545-01-01

Samplers: (Signature) ITI

Sampling Contact: Jane Sexton

Phone: 206-643-9513

Ship Samples to: NAS

Attn: Dick Caldwell

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: Unknowns TCL						Extra Container	Archive	Remarks
WE017	65077	3/29	1702				✓				G	✓								1 of 3
WE017	65078	3/29	1702				✓				G	✓								2 of 3
WE017	65079	3/29	1702				✓				G	✓								3 of 3
WE015	65104	3/29	1605				✓				G	✓								1 of 3
WE015	65105	3/29	1605				✓				G	✓								2 of 3
WE015	65106	3/29	1605				✓				G	✓								3 of 3
WE014	65115	3/29	1820				✓				G	✓								1 of 3
WE014	65116	3/29	1820				✓				G	✓								2 of 3
WE014	65117	3/29	1820				✓				G	✓								3 of 3
WE022	65126	3/30	1324				✓				G	✓								1 of 3
WE022	65127	3/30	1324				✓				G	✓								2 of 3
WE022	65128	3/30	1324				✓				G	✓								3 of 3
WE023	65137	3/30	1425				✓				G	✓								1 of 3
WE023	65138	3/30	1425				✓				G	✓								2 of 3

Method of Shipment: Overnight Express

Condition of Samples Upon Receipt: _____

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: _____

Relinquished by: Jane Sexton (Signature) — Received by: _____ (Signature) — Date/Time _____

Relinquished by: _____ (Signature) — Received by: _____ (Signature) — Date/Time _____

Relinquished by: _____ (Signature) — Received by Mobile Lab for Field Analysis: _____ (Signature) — Date/Time _____

Received for Lab by: _____ (Signature) — Date/Time _____

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2912

Project: (Name and Number) EVERETT 0045.01.01

Samplers: (Signature) T T E

Sampling Contact: Jane Sexton

Phone: 206.682.9502

Ship Samples to: NAS

Attn: Dick Caldwell

Sample No.	Tag No.	Date	Time	Sample Matrix: Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	Analyses Requested: PHENOLS 16+ SIM						Extra Container	Archive	Remarks
WEL23	65139	3/30	1455				✓				G	✓								2 of 3
WEL24	65148	3/30	1614				✓				G	✓								1 of 2
WEL24	65149	3/30	1614				✓				G	✓								2 of 3
WEL24	65150	3/30	1614				✓				G	✓								3 of 3
WEU21	65167	3/30	1903				✓				G	✓								1 of 2
WEU21	65168	3/30	1903				✓				G	✓								2 of 2
WEU21	65169	3/30	1903				✓				G	✓								3 of 3

Method of Shipment: Overnight Express

Condition of Samples Upon Receipt: _____

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: _____

Relinquished by: Jane Sexton (Signature) Received by: _____ (Signature) Date/Time _____

Relinquished by: _____ (Signature) Received by: _____ (Signature) Date/Time _____

Relinquished by: _____ (Signature) Received by Mobile Lab for Field Analysis: _____ (Signature) Date/Time _____

Received for Lab by: _____ (Signature) Date/Time _____

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PTI ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2916

Page 1 of 1

Project: (Name and Number) EVERETT C495-01-01

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-643-9802

Ship Samples to: NAS

Attn: Vick Caldwell

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	KRINGSAYS PCK-SIN						Extra Container	Archive	Remarks
WE003	65186	3/21	1604				✓				G	✓								1 of 2
WE003	65157	3/21	1604				✓				G	✓								2 of 3
WE003	65156	3/21	1604				✓				G	✓								3 of 3
WE010	65221	4/1	0619				✓				G	✓								1 of 2
WE010	65222	4/1	0619				✓				G	✓								2 of 2
WE010	65223	4/1	0619				✓				G	✓								2 of 2
WE011	65232	4/1	0627				✓				G	✓								1 of 3
WE011	65233	4/1	0627				✓				G	✓								2 of 2
WE011	65234	4/1	0637				✓				G	✓								3 of 3
WE012	65243	4/1	0721				✓				G	✓								1 of 3
WE012	65244	4/1	0721				✓				G	✓								2 of 2
WE012	65245	4/1	0721				✓				G	✓								3 of 3

Method of Shipment: Overnight Express

Condition of Samples Upon Receipt: ____

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ____

Relinquished by: Jane Sexton (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by Mobile Lab for Field Analysis: ____ (Signature) Date/Time ____

Received for Lab by: ____ (Signature) Date/Time ____

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PTI
ENVIRONMENTAL SERVICES

CHAIN OF CUSTODY RECORD/ SAMPLE ANALYSIS REQUEST FORM

2922

Page 1 of 1

Project: (Name and Number) EVERETT [illegible]

Samplers: (Signature) PTI

Sampling Contact: Jane Sexton

Phone: 206-643-9803

Ship Samples to: NMFS

Attn: Dick Caldwell

Sample No.	Tag No.	Date	Time	Groundwater	Soil	Surface Water	Sediment	Other	Other	Concentration (L M H)	Composite or Grab	[illegible]						Extra Container	Archive	Remarks
WE013	L5254	4/1	1430				✓				G	✓								
WE013	L5255	4/1	1430				✓				G	✓								
WE013	L5256	4/1	1430				✓				G	✓								

Method of Shipment: Overnight Express

Condition of Samples Upon Receipt: ____

Custody Seal Intact: Yes ☐ No ☐ None ☐ Broken by: ____

Relinquished by: Jane Sexton (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by: ____ (Signature) Date/Time ____

Relinquished by: ____ (Signature) Received by Mobile Lab for Field Analysis: ____ (Signature) Date/Time ____

Received for Lab by: ____ (Signature) Date/Time ____

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APPENDIX C

Laboratory Data Reports

(not provided with draft report)

Weyerhaeuser Laboratory

Northwestern Aquatic Sciences

APPENDIX D

Station Cluster Worksheets

WORKSHEET 1
Station Cluster Screening Using Chemical Data

Station Cluster ID: OUTFALL WK005

(see reverse side for list of stations)

Contaminant	3 Highest Concentrations			Average of 3 Highest Concentrations	Average Exceeds CSL?	
	1	2	3		Yes	No
1. 4-METHYLPHENOL	790	28 U	24 U	280	☐	☑
2.					☐	☐
3.					☐	☐
4.					☐	☐
5.					☐	☐
6.					☐	☐
7.					☐	☐
8.					☐	☐
9.					☐	☐
10.					☐	☐
11.					☐	☐
12.					☐	☐
13.					☐	☐
14.					☐	☐
15.					☐	☐
16.					☐	☐
17.					☐	☐
18.					☐	☐
19.					☐	☐
20.					☐	☐

Station Cluster Designation:

☑ Station cluster of low concern (no averages exceed CSL)

☐ Station cluster of potential concern (at least one average exceeds CSL)

Name: JANE SEXTON Date: 7/21/94

List the stations that are included in the station cluster:

1. WS-01
2. WS-02
3. WS-03
4. WS-04
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.

WORKSHEET 1
Station Cluster Screening Using Chemical Data

Station Cluster ID: OUTFALLS WK002 & WK004
(see reverse side for list of stations)

Contaminant	3 Highest Concentrations			Average of 3 Highest Concentrations	Average Exceeds CSL?	
	1	2	3		Yes	No
1. TOTAL PCBs	19	0.91	0.75	6.9	☐	☑
2.					☐	☐
3.					☐	☐
4.					☐	☐
5.					☐	☐
6.					☐	☐
7.					☐	☐
8.					☐	☐
9					☐	☐
10.					☐	☐
11.					☐	☐
12.					☐	☐
13.					☐	☐
14.					☐	☐
15.					☐	☐
16.					☐	☐
17.					☐	☐
18.					☐	☐
19.					☐	☐
20.					☐	☐

Station Cluster Designation:

☑ Station cluster of low concern (no averages exceed CSL)

☐ Station cluster of potential concern (at least one average exceeds CSL)

Name: JANE SEXTON Date: 7/21/94

List the stations that are included in the station cluster:

1. W2-01
2. W2-02
3. W4-01
4. W4-02
5. W4-03
6. SR-01
7. SR-02
8. SR-03
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.

WORKSHEET 2
Station Cluster Screening Using Biological Data

Station Cluster ID: WK001
(see reverse side for list of stations)

	Amphipod Bioassay	Larval Bioassay BIVALVE	Chronic Test	Total Tests Failed	Fail *	Pass
Station # ____	Fails SQS ☐ Fails CSL ☐	Fails SQS ☒ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS 1 Fails CSL 0	☐	☒
Station # ____	Fails SQS ☐ Fails CSL ☐	Fails SQS ☒ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS 1 Fails CSL 0	☐	☒
Station # ____	Fails SQS ☐ Fails CSL ☐	Fails SQS ☒ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS 1 Fails CSL 0	☐	☒

* A station fails if 2 or more tests fail SQS or if one or more tests fail CSL; see Table B-2.

Station Cluster Designation:
- ☒ Station cluster of low concern (0-2 stations fail)
- ☐ Station cluster of potential concern (all 3 stations fail)

Name: JANE SEXTON Date: 7/21/94

List the stations that are included in the station cluster:

1. WI-01
2. WI-02
3. WI-03
4. SS-01
5. SS-02
6. SS-03
7. SS-04
8. SS-05
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.

WORKSHEET 2
Station Cluster Screening Using Biological Data

Station Cluster ID: WK005
(see reverse side for list of stations)

	Amphipod Bioassay	Larval Bioassay BIVALVE	Chronic Test JUVENILE POLYCHAETE	Total Tests Failed	Fail *	Pass
Station # W5-01	Fails SQS ☐ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS ☒ Fails CSL ☐	Fails SQS 1 Fails CSL 0	☐	☒
Station # W5-02	Fails SQS ☐ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS ☐ Fails CSL ☐	Fails SQS 0 Fails CSL 0	☐	☒
Station # W5-03	Fails SQS ☐ Fails CSL ☐	Fails SQS ☒ Fails CSL ☒	Fails SQS ☐ Fails CSL ☐	Fails SQS 1 Fails CSL 1	☒	☐

* A station fails if 2 or more tests fail SQS or if one or more tests fail CSL; see Table B-2.

Station Cluster Designation:

☒ Station cluster of low concern (0-2 stations fail)

☐ Station cluster of potential concern (all 3 stations fail)

Name: JANE SEXTON Date: 7/21/94

List the stations that are included in the station cluster:

1. WS-01
2. WS-02
3. WS-03
4. WS-04
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.