CAPITOL LAKE 2000
ADAPTIVE MANAGEMENT PLAN

Sediment Sampling and Analysis Plan and Quality Assurance Plan

Prepared for

Entranco

and

Washington Department of General Administration

March 2000 Draft

HERRERA
ENVIRONMENTAL
CONSULTANTS

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Contents

Tables

Figures

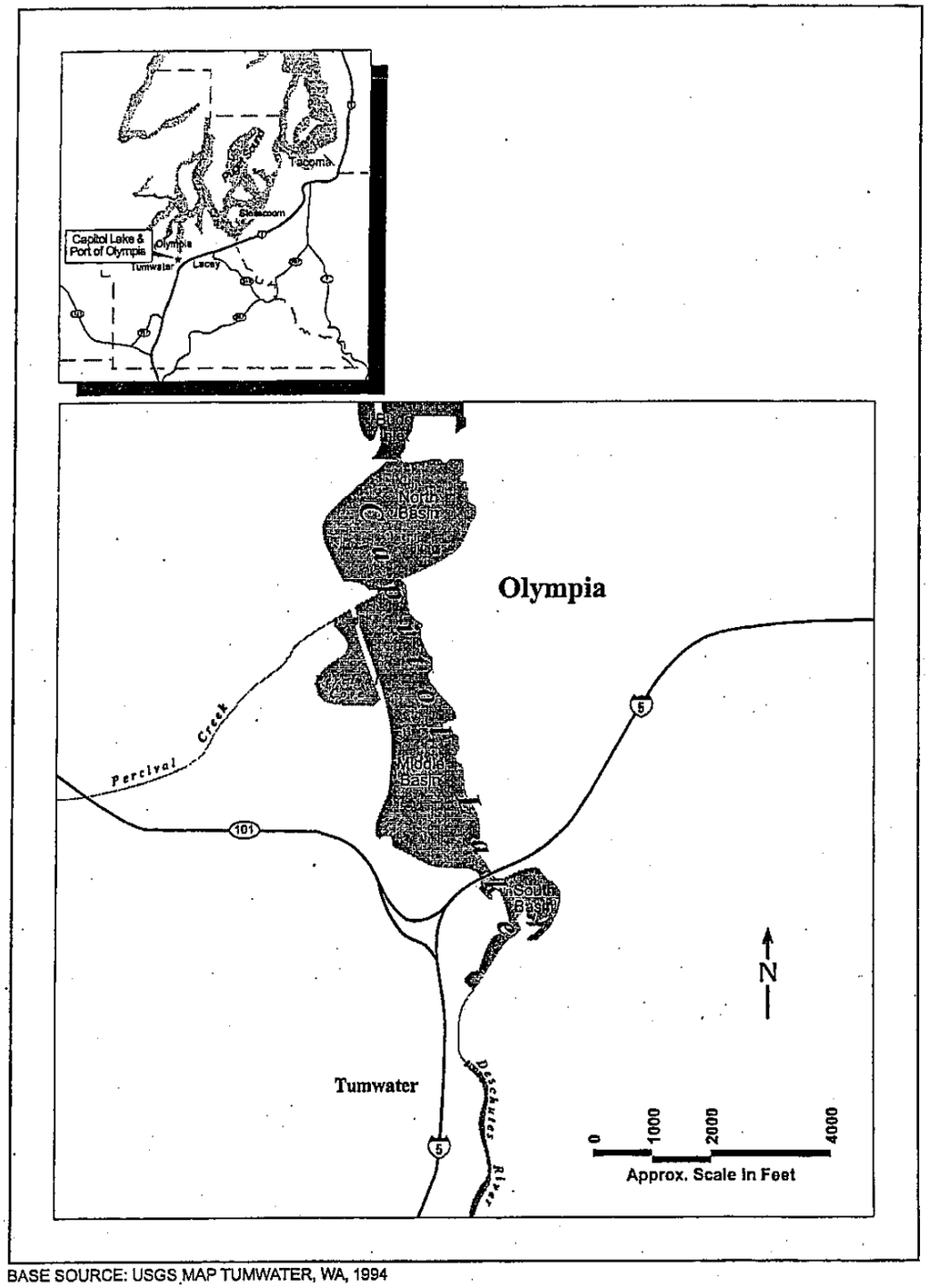
1.0 Introduction

This sampling and analysis plan (SAP) and quality assurance plan (QAP) addresses the preliminary sediment characterization of the middle basin sediment trap of Capitol Lake, Olympia Washington (Figure 1). As part of the *Capitol Lake Adaptive Management Plan*, the Washington State Department of General Administration (DGA) is evaluating several management alternatives to optimize the beneficial uses of Capitol Lake (i.e., recreation, aesthetics, fisheries, and flood control). In addition, it is DGA's goal to manage sediment within the basin in the most cost-effective and environmentally appropriate way.

In light of this goal, this SAP analyzes and evaluates the dredgibility of sediment for the middle basin sediment trap of Capitol Lake. Capitol Lake is filling with sediment at an estimated rate of 30,000 to 35,000 cubic yards per year and the middle basin will evolve into freshwater wetlands over a period of 50 to 85 years without maintenance dredging (Entranco 1996). Alternatively, dredging is not necessary if DGA selects an estuary or no action alternative. If a management alternative that includes dredging the middle basin sediment trap is selected, a dredging plan will be prepared and the accumulated sediments will require disposal at either an upland disposal site or an open-water disposal site in Puget Sound.

Sediment chemistry testing is required under the Puget Sound Dredged Disposal Analysis (PSDDA) program to determine whether sediments are suitable for open-water disposal in Puget Sound. The PSDDA program is part of the Dredge Material Management Program (DMMP) for Washington state. The four cooperating agencies responsible for the management of dredged material include U.S. Army Corps of Engineers (U.S. COE); U.S. Environmental Protection Agency (U.S. EPA); Washington Department of Ecology (Ecology); and Washington Department of Natural Resources (DNR). For upland disposal, sediment chemistry testing requirements vary with the disposal facility and local jurisdictions (e.g., county health department), but generally follow Ecology guidelines for the Model Toxics Control Act (MTCA) (WAC 173-340) and dangerous waste regulations (WAC 173-303).

Previous sediment characterizations of the middle basin were completed in 1994 and 1995 (Entranco 1994, 1996). The 1994 characterization measured low concentrations of selected metals, polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). At that time it was determined that the middle basin sediments were suitable for upland disposal. The 1995 PSDDA characterization measured 76 required PSDDA parameters at concentrations below the PSDDA screening level, except for benzoic acid. Benzoic acid was detected at three of six sample locations at concentrations exceeding the PSDDA maximum level criterion. However, benzoic acid concentrations were below the detection limit at the two sample locations in the sediment trap. The high concentrations of benzoic acid were unexpected because no known source of this contaminant exists in the watershed. Therefore, it is possible that the high benzoic acid concentrations measured in 1995 were from a historical source, and that sediment concentrations may be significantly lower in 2000.



BASE SOURCE: USGS MAP TUMWATER, WA, 1994

Figure 1. Vicinity map of Capitol Lake, Olympia, Washington.

The DGA is proposing to perform a preliminary sediment characterization of the middle basin sediment trap for several reasons:

- If the DGA selects a management alternative that includes dredging, the sediment trap will likely be the first area dredged
- The data collected in 1994 and 1995 are no longer valid for determining whether sediments can be disposed of in the open waters of Puget Sound or at an upland site
- There is a reason to believe that benzoic acid concentrations in the sediment may be less than those measured in 1995
- A 1998 spill of pavement sealer on Interstate 5 near Capitol Lake may have contaminated the sediments with hydrocarbons.

The objective of this preliminary characterization is to further evaluate dredging as a lake management alternative and to assess the acceptability of dredged sediments from the sediment trap for either open-water disposal in Puget Sound or upland disposal. This document, which has been developed in accordance with PSDDA (2000) guidelines, presents the sampling and analysis procedures to be followed during this preliminary sediment characterization. Also included in this document are the quality assurance and quality control (QA/QC) procedures to be followed in the field and laboratory during the collection and analysis of sediment samples. These procedures are presented in the quality assurance plan (QAP) portion of this document.

2.0 Project Description and Site History

2.1 Project Organization

The project organization chart presented in Figure 2 identifies the relationships and lines of communication among the major participants of this project. Herrera Environmental Consultants is a subcontractor to Entranco and is responsible for completing the sediment sampling field work for DGA. Herrera also is responsible for data validation of the laboratory testing results (see section 6). Chemical and conventional parameter testing will be conducted by Analytical Resources, Inc., and biological testing of sediments, if warranted, will be conducted by EVS Consultants. Responsibilities of key personnel associated with this project are identified in Figure 2.

2.2 Project Description

As part of the *Capitol Lake Adaptive Management Plan*, the Washington State Department of General Administration is evaluating management alternatives to maintain the beneficial uses of Capitol Lake (i.e., recreation, aesthetics, fisheries, and flood control). Dredging the middle basin or a portion of it is included in several of the management alternatives currently under evaluation. Dredging is considered necessary to maintain an open-water lake, because the middle basin is filling with sediment at an estimated rate of 30,000 to 35,000 cubic yards per year and will completely fill with sediment within 50 to 85 years (Entranco 1996).

If dredging is included in the management alternative selected, dredging depths in the sediment trap would range from 3 to 4 feet over a 12-acre area for a total volume of dredged sediment of approximately 70,000 cubic yards (Entranco 1999). Based on these estimated dredging volumes, the middle basin sediment trap was divided into two dredging sectors, each containing approximately 35,000 cubic yards of sediment (Figure 3). Although these assumptions were used for this PSDDA analysis, a dredging plan has not been developed, and dredging may not be conducted.

For this preliminary sediment characterization, one 4-foot core will be collected from two sampling sites in each of the two dredging sectors in the middle basin sediment trap (Figure 3). If necessary due to incomplete core recovery, replicate cores will be collected and composited into one sample per site for a total of four samples. The samples will be tested for all PSDDA parameters. In addition, the samples will be analyzed for petroleum hydrocarbons to satisfy upland disposal requirements. Results will be compared to PSDDA criteria and the states Model Toxics Control Act (MTCA) cleanup regulation method A soil cleanup criteria (Washington Administrative Code [WAC] 173-340-740). If any contaminant is present at a concentration that exceeds the PSDDA screening level, then associated locations may be resampled and tested for bioassay analysis. If any contaminant is present at a concentration that exceeds MTCA method

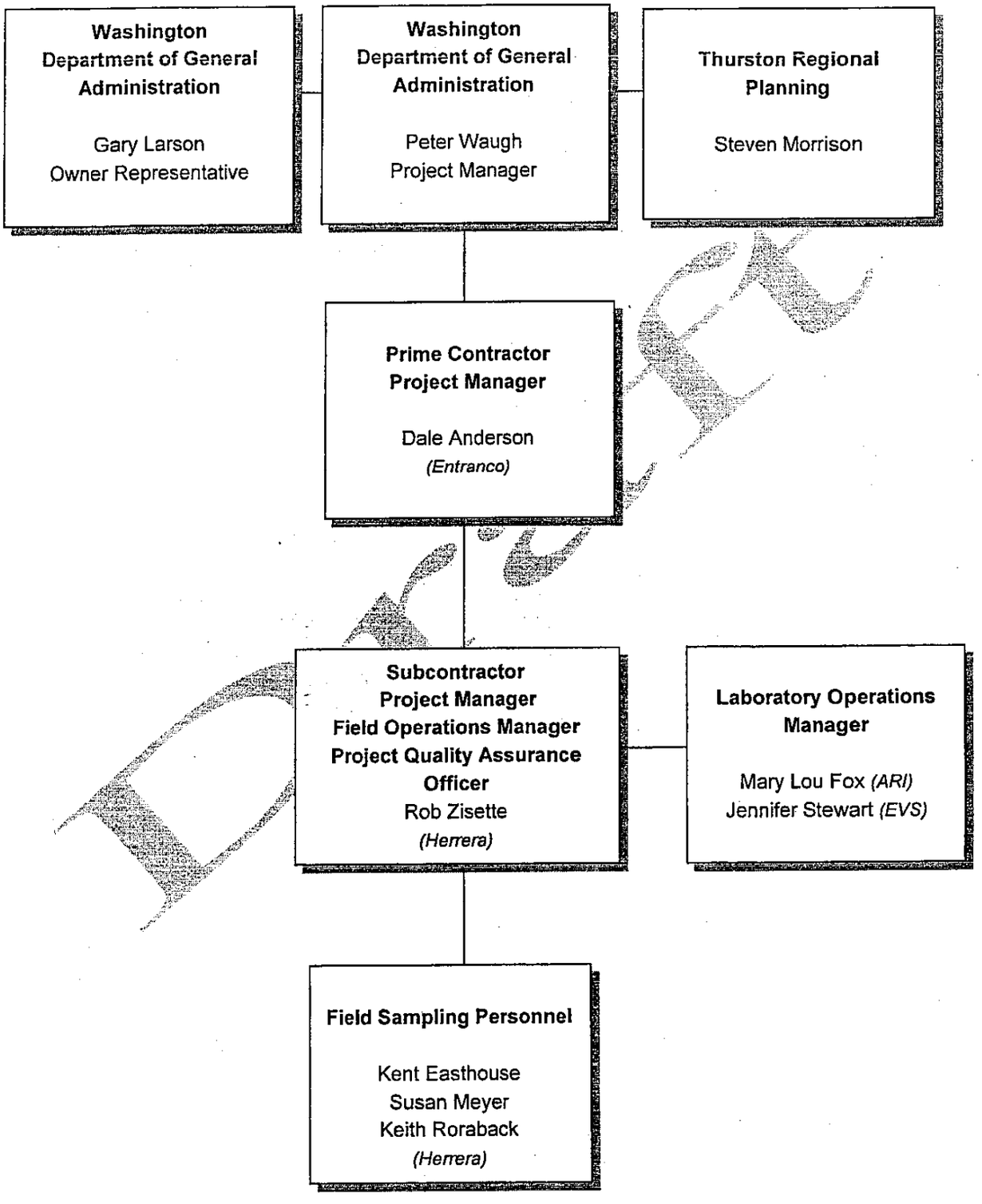
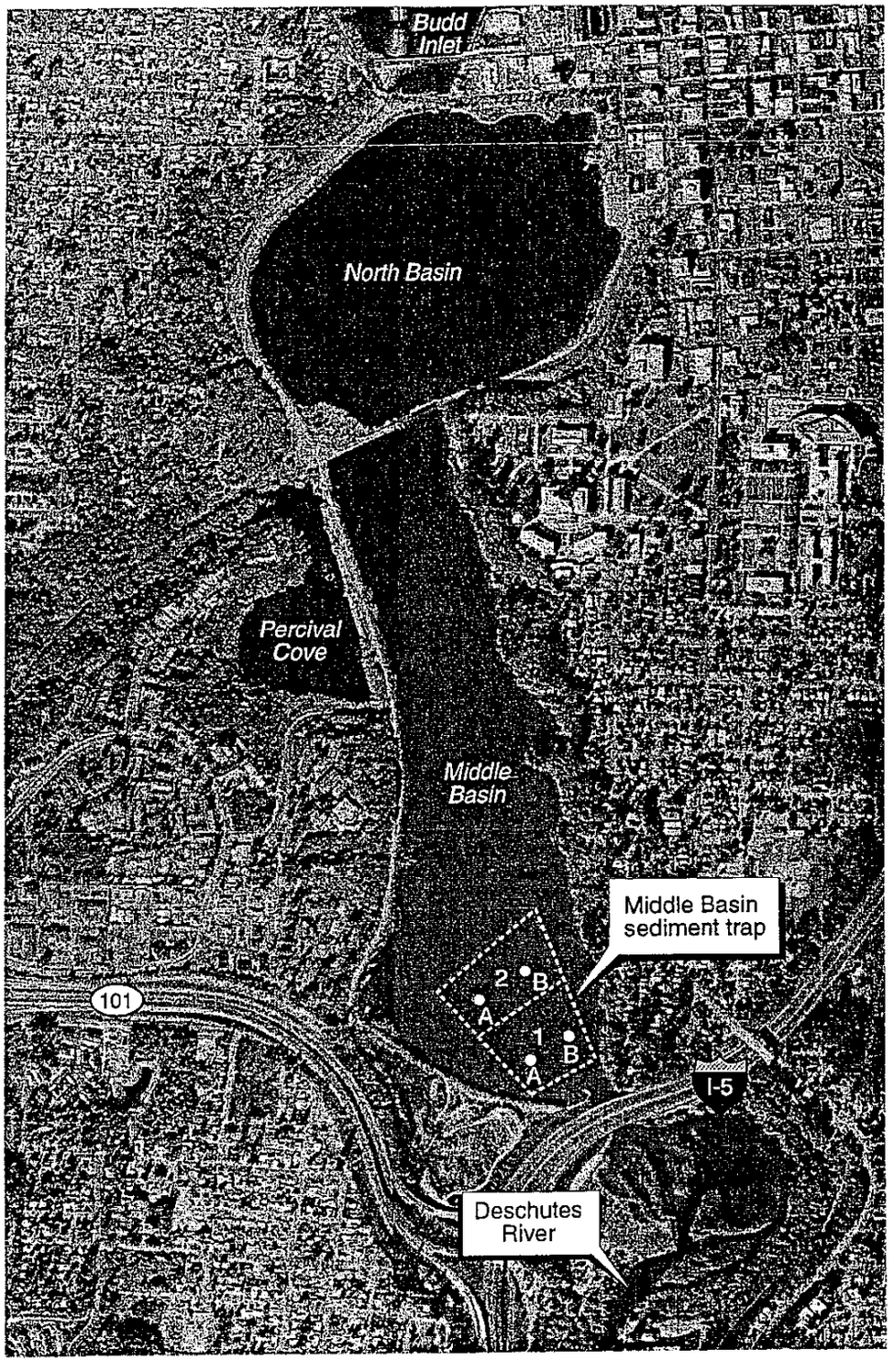


Figure 2. Sediment monitoring organization chart.



Legend

----------	Dredged section boundary
1	Dredged section number
• A	Sediment sampling sites

0 1000 feet

Approximate scale

Figure 3. Capitol Lake middle basin sediment trap dredging sectors and proposed PSDDA sampling locations.

A criteria, then an archived sample may be tested for dangerous waste constituents using toxicity characteristic leaching procedure (TCLP) methods. However, collection and analysis of sediment samples for bioassay testing and TCLP analysis are beyond the current project scope and would require authorization and budget by DGA.

If dredging is determined to be a viable management alternative, the dredging sector sediments that pass PSDDA criteria will be suitable for disposal at an approved PSDDA open-water disposal site. The dredging methods to be used in Capitol Lake have not yet been determined. However, because PSDDA will not accept non-dewatered dredged sediment at non-dispersive open-water disposal sites (Benson 2000 personal communication), all dredging options must include dewatering sediments prior to open-water disposal. In addition, PSDDA is concerned with the presence of purple loosestrife seeds in sediments from the middle basin (see section 2.3.3) and the possibility of spreading an identified noxious weed through unconfined disposal of sediments containing its seeds. The DNR has stated that sediments dredged from the middle basin are not suitable for open-water disposal unless they are disposed of in geo-tubes or a similar device designed to prevent the dispersal of seeds into Puget Sound (Benson 2000 personal communication). Therefore, if open-water disposal of the middle basin sediment is considered a viable option, all sediments will require dewatering and disposal in geo-tubes or some other similar device to prevent the dispersal of purple loosestrife seeds.

Any dredging sector materials that fail PSDDA criteria will require disposal at an approved upland location. As previously noted, testing archived samples for dangerous waste constituents using TCLP methods may be required, depending on the chemistry testing results.

2.3 Site History

This section describes the site history of Capitol Lake and includes background information, historical chemical data, information on purple loosestrife seeds that are present in the middle basin sediments, and information on dredging and disposal requirements. Historical sediment chemical data collected in 1994 and 1995 are presented in Appendix A and B, respectively.

2.3.1 Background Information

Capitol Lake was formed in 1951 by an act of the Washington State Legislature, which authorized the construction of a dam at the Fifth Avenue bridge to create a reflecting pool for the capitol campus as designed by New York architects Wilder and White in 1911. The creation of Capitol Lake also provided a freshwater environment, which eventually became the central feature of park and recreational facilities for the capitol campus and the cities of Olympia and Tumwater.

The formation of Capitol Lake has resulted in accelerated sediment accumulation within the middle basin. An estimated 30,000 to 35,000 cubic yards of sediment accumulates in the lake each year. The DGA completed a long-range sediment removal and lake recreation plan in 1977 (CH2M Hill 1977). Initial work under this plan, carried out between 1978 and 1982, included removing 257,000 cubic yards of sediment and constructing sediment traps in the south and middle basins. Additional maintenance dredging, which involved removing 60,000 cubic yards

of sediment, was conducted in 1986 (Ebasco 1986). Sediment removal to date totals 314,000 cubic yards. Consequently, a net accumulation of approximately 1.2 million cubic yards of sediment (1.5 million minus 300,000) has been deposited in the lake since 1951, and the lake has become shallower each year.

Based on the average grain size distribution in 15 sediment cores collected throughout the middle basin, surface sediments (0 to 3 feet) in the middle basin of Capitol Lake consist primarily of silts (59 percent), sands (26 percent), and clays (11 percent) (CH2M Hill 1976; Hong West 1994). Some natural sorting of material occurs in the middle basin, where sands tend to drop out in the upper portion of the basin near the sediment trap, and finer silts and clays tend to accumulate elsewhere throughout the lake.

The primary land use in the Deschutes River watershed is forest (59 percent), with lesser amounts in rural and agricultural uses (35 percent) and urban use (6 percent). Potential sources of contaminants include several stormwater outfalls that convey runoff from the adjacent roadways and Interstate 5 directly into Capitol Lake.

2.3.2 Historical Chemical Data

During 1994, 20 sediment samples were collected in the middle basin of Capitol Lake to determine whether sediments were suitable for upland disposal (Entranco 1994; Appendix A). The samples were analyzed for selected metals (arsenic, cadmium, copper, lead, mercury, and zinc), PCBs, TPH, and total solids. Metals analysis included total metals, TCLP metals, and elutriate testing for metals. Chemical analysis indicated that the sediments had concentrations of metals, PCBs, and TPH below MTCA method A soil cleanup levels.

Chemical testing confirmed that there will be no risk to aquatic life from sediment disturbance within the lake, or from chemicals leaching out of sediments disposed of at remote upland disposal sites. Moreover, concentrations of PCBs and metals in the sediments were below the maximum allowable concentrations under both the state dangerous waste regulations (WAC 173-303) and the Thurston County high risk waste evaluation guidelines (Thurston County 1991). Entranco (1994) concluded that sediments from Capitol Lake were suitable for upland disposal.

During 1995, a PSDDA sediment characterization was conducted to determine whether sediments were suitable for open-water disposal in Puget Sound (Entranco 1995a, 1996; Appendix B). Sediments were sampled from six dredging sectors (designated as Sectors 1, 2, 3, 8, 9, and 10) (Figure 4) following PSDDA protocols. The middle basin sediment trap is located entirely within sectors 1 and 2. Four cores were collected from each sector, then composited into one sample per sector, and analyzed for 76 required PSDDA parameters. Results indicated that all chemical concentrations were below PSDDA screening level criteria except for benzoic acid. Benzoic acid concentrations were below the detection limit of 20 micrograms per kilogram (µg/kg) at sectors 1 and 2 (the middle basin sediment trap) and 10, but were above the PSDDA maximum level criterion of 760 µg/kg at sectors 3, 8, and 9. Benzoic acid was measured at concentrations of 2,700 µg/kg, 1,900 µg/kg, and 1,700 µg/kg at sectors 3, 9, and 8, respectively.

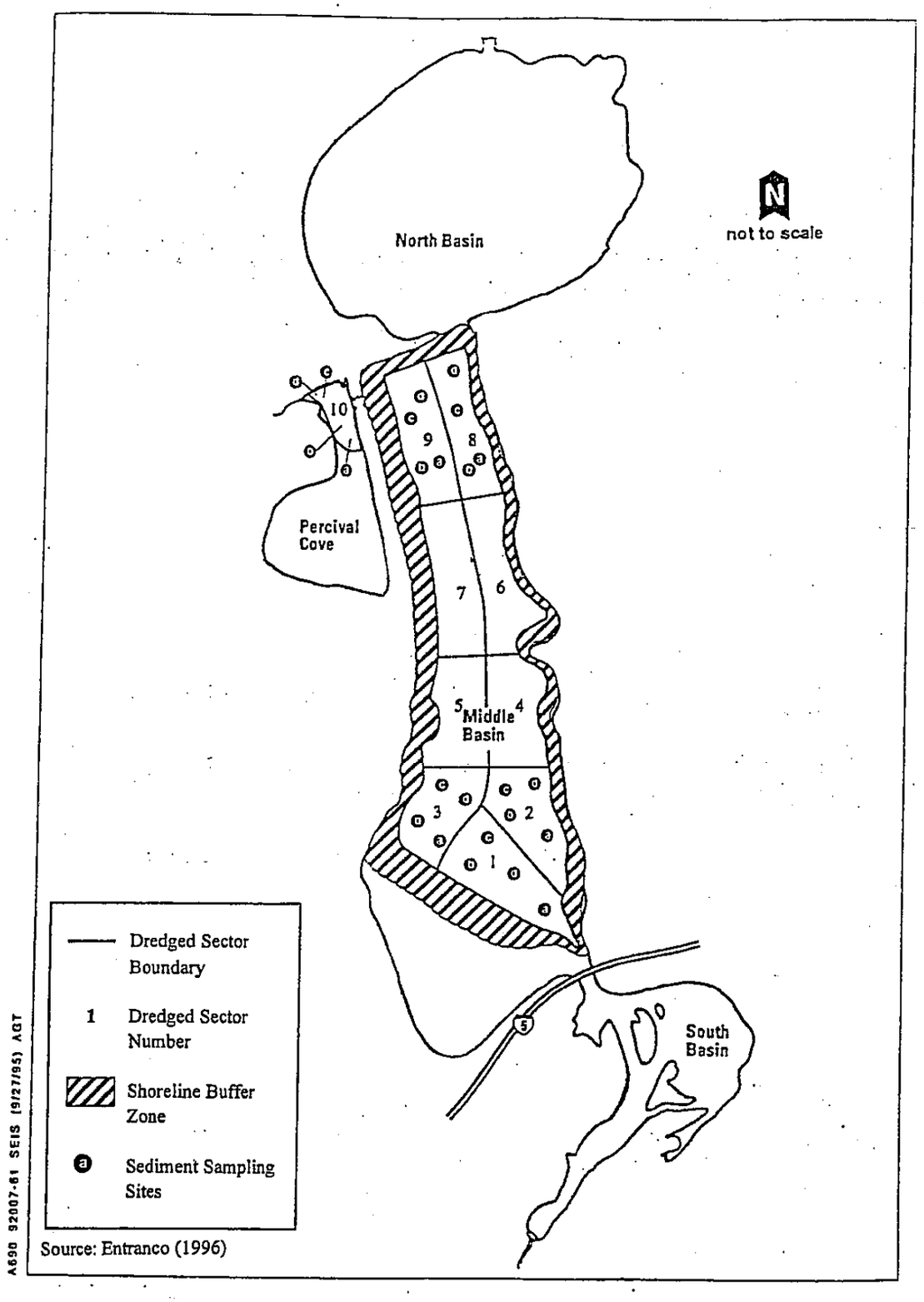


Figure 4. 1995 PSDDA sampling locations in Capitol Lake.

Chemical analysis in 1995 indicated that sediments dredged from sectors 3, 8, and 9 could not be disposed of in the open waters of Puget Sound. Because few known sources of benzoic acid exist in the Capitol Lake watershed, Entranco (1995b) proposed collecting additional samples from these sectors to determine the validity of the benzoic acid data. However, additional sediment testing was never completed, and the validity of the benzoic acid data is still in question.

2.3.3 Purple Loosestrife Seeds

Purple loosestrife is a noxious wetland plant targeted for control or eradication in Washington by the Washington State Department of Agriculture. Purple loosestrife disrupts wetland ecosystems by displacing native plants and animals. Waterfowl, fur-bearing animals, and birds vacate wetland habitat when their food source, nesting material, and ground cover are eliminated due to purple loosestrife infestations (Ecology 1999). The southern part of Capitol Lake has been identified by the Thurston County Noxious Weed Control Agency as a quarantine site for this plant (Entranco 1996).

Purple loosestrife seeds are present in the middle basin sediments. Studies were conducted in 1996 by the Washington State University seed technology laboratory to determine whether purple loosestrife seeds collected from Capitol Lake could remain viable and germinate in saline waters (WSU 1997). This study concluded that seeds removed from the middle basin were able to germinate in waters with salinities as high as 25 parts per thousand (ppt). Salinity concentrations greater than 25 ppt appeared to inhibit seed germination. In addition, tests showed that seeds were not able to germinate in Budd Inlet water due to the high salinity concentrations (28 ppt) and cold temperatures. However, seeds remained viable in Budd Inlet water for up to 2 to 3 weeks and germinated when transferred to lower salinity waters. Purple loosestrife seeds were also shown to be capable of floating in Budd Inlet water. These data suggest that although purple loosestrife seeds released into Puget Sound could not germinate in the saline water, they could be transported by currents to nearshore areas where germination in nearshore brackish waters may be possible (WSU 1997). However, purple loosestrife occurs throughout the Puget Sound basin and has not been documented to occur in saline shoreline areas of the sound.

3.0 PSDDA Ranking Scheme and Sampling Requirements

3.1 PSDDA Ranking Scheme

PSDDA assigns a proposed dredging site to one of four possible ranks (i.e., high, moderate, low/moderate, or low) based upon the nature and extent of possible sources of chemicals of concern that could contaminate sediments to be dredged. For dredging projects with sufficient historical data, the assigned ranking is based on the available chemical and biological data (PSDDA 2000). Based on the results of the 1995 PSDDA sediment characterization (see Appendix B), Capitol Lake would be assigned a high rank, because benzoic acid concentrations exceeded the PSDDA maximum level criterion.

3.2 PSDDA Sampling Requirements

The PSDDA (2000) protocol for a full characterization of surface sediments (0 to 4 feet) from a high-ranked dredging area requires one core section for every 4,000 cubic yards of sediment, and one analysis for every 4,000 cubic yards of sediment. Subsurface sediments (4 to 8 feet) are characterized by one core section for every 4,000 cubic yards of sediment, and one analysis for every 12,000 cubic yards of sediment.

A dredging proponent may choose to perform a partial characterization of project sediments instead of a full characterization if there is a reason to believe that a lower ranking is appropriate. A partial characterization is designed to be simple and economical, and is based on the chemical analysis of a limited number of samples. If partial characterization data indicate that the project has been over-ranked, then down-ranking may be permitted for a subsequent full characterization. Partial characterization results may be used to downrank a project on a one-time basis only. At the discretion of the DMMP agencies, partial characterization data may be used for partial fulfillment of a full characterization.

The number of samples required for a partial characterization is based on a percentage of the number of samples required for a full characterization. To lower a rank one level, 10 percent of the full characterization minimum surface sample requirements must be analyzed. To lower a rank two levels, 20 percent of the full characterization minimum surface samples must be analyzed. In addition, a partial characterization may be performed on sub-areas of the project, with the approval of PSDDA. Compositing of samples from different locations is not permitted, and sampling station delineation must be approved in advance by PSDDA.

For dredging of the middle basin sediment trap, the proposed dredging volume is 70,000 cubic yards. A full characterization of 70,000 cubic yards of sediment would require collecting and

analyzing 18 surface samples; a partial characterization to lower a rank one level would require collecting and analyzing two surface samples; and a partial characterization to lower a rank two levels would require collecting and analyzing four surface samples. The present partial characterization sediment sampling plan includes collection and analysis of four surface samples and would be sufficient to lower the rank two levels from high to low/moderate for the assumed dredging volume. Table 1 compares the PSDDA sampling and testing requirements for the full characterization, the two partial characterizations, and the present sampling plan.

It is important to recognize that dredging may not occur in the future and that a dredging plan has not been developed. In addition, the present sediment sampling plan does not include the collection of subsurface (4 to 8 feet) samples, because the depth of sediment removal is assumed to be between 3 and 4 feet in the middle basin sediment trap (Entranco 1999).

Table 1. Comparison of PSDDA sampling and testing requirements for a full characterization, a partial characterization, and the present sampling plan.

Dredging Sector	Proposed Dredging Volume (cubic yards)	Full Characterization Sampling Requirements for a High-Rank Site		Partial Characterization Sampling Requirements to Lower a Rank by One Level		Partial Characterization Sampling Requirements to Lower a Rank by Two Levels		Present Sampling and Analysis Plan	
		Minimum Number of Cores to Collect	Minimum Number of Samples to Analyze	Minimum Number of Cores to Collect	Minimum Number of Samples to Analyze	Minimum Number of Cores to Collect	Minimum Number of Samples to Analyze	Minimum Number of Cores to Collect	Minimum Number of Samples to Analyze
1	35,000	9	9	0.9	0.9	1.8	1.8	2	2
2	35,000	9	9	0.9	0.9	1.8	1.8	2	2
Total	70,000	18	18	1.8	1.8	3.6	3.6	4	4

4.0 Sample Collection and Handling Procedures

4.1 Sampling Scheme

The proposed sampling scheme separates the middle basin sediment trap into two dredge sectors, each containing approximately 35,000 cubic yards of sediment (see Figure 3). One 2-inch-diameter, 4-foot-long core will be collected from two locations in each dredge sector. Each core will provide sufficient sample volume (i.e., 2.5 liters) for physical and chemical analysis if full recovery (4 feet) is achieved. Replicate cores will be collected and composited into one sample per location if full recovery is not achieved. The proposed sample compositing scheme is presented in Table 2.

Table 2. Proposed Capitol Lake sample compositing plan.

Dredge Sector	Sample Site	Individual Core Designations	Sample Number	Approximate Sector Volume (cubic yards)
1	1-A	1-A-1, 1-A-2, etc.	1-A	35,000
	1-B	1-B-1, 1-B-2, etc.	1-B	
2	2-A	2-A-1, 2-A-2, etc.	2-A	35,000
	2-B	2-B-1, 2-B-2, etc.	2-B	

Based on review of preliminary chemistry results, additional cores may be collected for bioassay analyses if approved by DGA. If one or more chemical contaminant concentrations exceed the PSDDA screening level, then replicate cores may be collected from one or more associated locations. The replicate cores would be composited in accordance with the scheme outlined above to obtain a minimum sample volume of 5 liters.

4.2 Field Sampling Activities

This section identifies specific procedures for locating sediment sampling sites, collecting sediment samples, decontaminating sampling equipment, and preparing field notes. It also describes requirements for sample containers and preservation, sample identification, sample transport, and sample custody.

4.2.1 Sediment Sampling Locations

Each dredge sector will be divided into two sub-sectors of equal area and volume (see Figure 3). The sediment coring stations will be located near the center of each sub-sector. The coordinates of each sample site will be determined from a detailed map prior to initiating the sampling. On

the day preceding sampling, buoys will be placed in the lake to mark the locations of the four sampling sites. A differential global positioning system (GPS) will be used to direct the boat to the predetermined site locations. On the day of sampling, the sample boat will be anchored as close as possible to each buoy, and the exact position of each sample location will be determined (using differential GPS) and recorded in field notebooks. Horizontal positions obtained by differential GPS will be measured in latitude and longitude to the nearest 0.01 second and converted to Washington state coordinate system south zone NAD 83. Accuracy of the differential GPS system is within ±3 meters. Elevations will be referenced to the city of Olympia datum and corrected to mean lower low water using the tide gauge.

4.2.2 Sediment Sampling Methods

Surficial sediment samples (0 to 4 feet) will be collected from a boat at each of the four stations using a 4-foot stainless steel hand sediment coring device with 2-inch-diameter liner tubes. The core liners are made of clear thermoplastic, and the end caps of each tube are made of polyethylene. Puget Sound Estuary Program protocols (PSEP 1997) will be employed for all sample collection. Procedures to be followed are listed below:

- Sampling personnel will position the boat at the appropriate station location.
- The coring device and all sampling equipment will be decontaminated before use (see section 4.3.3).
- Field sampling personnel aboard the boat will-hand drive the core sampler to a depth of 4 feet, or to the point of resistance. The sediment cores will be collected within a 20-foot radius of the predetermined location at each sediment sampling site. The exact sampling location will be determined using differential GPS.
- After each core is collected, water will be slowly decanted from the core tube, and both ends of the tube will be capped and taped. The core will be extruded into a stainless steel pan aboard the boat, and sample observations will be made as described in section 4.2.7. If replicate cores are required, the sample pan will remain covered with aluminum foil and placed on ice until all core samples are collected and ready for mixing.
- Subsamples for analysis of sulfide and volatile organics will be collected from various locations in one randomly selected core prior to any mixing and subsampling for other analyses. For sulfide analysis, a subsample (approximately 50 grams) will be placed in the precleaned sample container, immediately followed by 5 milliliters (mL) of 2N zinc acetate. For volatile analysis, two subsamples will be placed in two separate

precleaned 4-ounce sample containers, with no headspace remaining in the containers.

- After a sufficient number of cores have been collected, the sediments will be homogenized using a decontaminated stainless steel spoon, until a consistent color and texture are achieved.

- One homogenized sample, determined to have an adequate volume, will be split to provide a field duplicate for physical and chemical testing.

- Sediment will be placed in the appropriate laboratory-cleaned containers and stored in a cooler at 4°C for transport to the laboratory. At the laboratory, each sample will be stored at approximately 4°C until analysis (except samples submitted for mercury analysis, which will be held at –18°C).

- An aliquot (8 ounces) of each sediment sample submitted for analysis will be archived and preserved at –18°C for additional analysis if necessary.

Each sample container will be clearly labeled with the project name, sample/composite identification, date and time, initials of persons preparing the sample, analysis specifications, and any pertinent information such as preservatives present in the sample. Each sample will be referenced by entry into the field log sheets.

4.2.3 Equipment Decontamination Procedures

All sampling equipment will undergo thorough cleaning and decontamination to prevent cross-contamination between samples. Decontamination will take place according to PSEP protocols between each sampling station, according to the following procedure:

- Rinse equipment with tap water (or lake water) to remove sediment
- Wash using brush and Alconox soap
- Triple rinse with tap water
- Rinse with nitric acid
- Triple rinse with deionized water.

After cleaning, all core tubes will be capped to limit the risk of contamination. Caps will be removed only when the tubes are loaded into the sampling device. The cutter head of the sampling device will be decontaminated immediately prior to insertion of the core tube. Spare core tubes will be available onsite in case of possible contamination of the original tube.

4.2.4 Sample Containers, Preservation, and Holding Times

Laboratory precleaned containers will be used for all sediment samples. Spare sample containers will be carried by the sampling team in case of breakage or possible contamination of the original containers. Sample containers, preservation techniques, and holding times will follow PSEP protocols (Appendix C).

4.2.5 Sample Identification and Labeling

Sample containers will be clearly labeled with the project name, sample identification number (e.g., 1-1), date and time of day, matrix, chemical analysis requested, and initials of the sampling personnel. Samples will be stored in a cooler at 4° C until transport to the laboratory.

4.2.6 Sample Transport and Custody

Samples will be transported on ice in a cooler to the laboratory within 24 hours of collection. A chain-of-custody record will accompany the samples (Appendix D). At the laboratory, the chain-of-custody form will be signed by the persons transferring custody of the samples. Copies of these forms will be retained by Herrera, and the originals will be retained by the laboratory. Upon return to the office, the signed chain-of-custody forms will be reviewed by the Herrera quality assurance officer.

4.2.7 Sample Logging/Documentation

During field sampling activities, a daily log will be maintained by the field staff. Information regarding sampling activities throughout the sampling day will be recorded in indelible ink, in a bound log book. In addition, photographs will be taken to document sampling procedures and sample integrity at each station. The following information regarding the samples will be logged in the field log book:

- Date, time, and name of persons collecting the samples
- Weather conditions
- Sampling station location/number
- Project designation
- Depth of water at the sampling station
- Sediment sample depth and sample recovery
- Any additional pertinent information, including documentation of field conditions encountered and any changes in sample station locations.

A sediment description of each sample will be recorded on the data log for the following parameters, as appropriate:

- Odor (e.g., hydrogen sulfide, petroleum)
- Visible stratifications and lenses

- Vegetation and debris
- Biological organisms and activity
- Presence of oil sheen
- Depth of sediment
- Any other distinguishing characteristics or features.

4.3 Reference Sediment Collection

Reference sediment sampling and testing are required only for bioassay testing. If bioassay testing is approved by DGA, reference sediments will be collected from Carr Inlet. Appropriate grain sizes will be collected according to those sample grain size results reported by the laboratory. Wet sieve grain size screening in the field will be the primary basis of reference site selection (this method usually agrees to within 10 percent fines of PSEP [laboratory] grain size results).

The field grain size determination procedure separates the sediment into two fractions: 1) greater than 62.5 micrometers (µm) (i.e., sand and gravel); and 2) less than 62.5 µm (i.e., silt and clay). This procedure is accomplished by wet-sieving approximately 50 mL of homogenized surface sediments. The surface sediments greater than 62.5 µm (i.e., sediment that does not pass through the sieve during the wet sieve process) are transferred into a 100-mL graduated cylinder. Percent fines are then calculated by dividing the remaining fraction by 50 and subtracting that amount from 100.

5.0 Laboratory Physical, Chemical, and Bioassay Analyses

The sediment samples will be analyzed for PSDDA parameters of concern and will be compared to PSDDA guidelines for open-water disposal. Chemical concentrations will be compared to screening level and maximum level values to determine whether bioassay testing is required. If bioassays are required and approved by DGA, additional samples will be collected and bioassay testing will be performed on one or more associated samples. Chemical concentrations will also be compared to Ecology MTCA method A criteria for upland disposal. If TCLP analysis are required and approved by DGA, the analysis will be performed on the archived sample. All physical, chemical, and bioassay analyses will be conducted in accordance with the quality assurance objectives described in section 6.

5.1 Physical and Chemical Analyses

The four sediment samples will be analyzed for the following parameters:

- Grain size
- Total solids
- Total organic carbon
- Ammonia
- Sulfide
- Total petroleum hydrocarbons
- Total recoverable metals (antimony, arsenic, cadmium, chromium copper, lead, mercury, nickel, silver, and zinc)
- Semivolatile organic compounds
- Volatile organic compounds
- Pesticides and polychlorinated biphenyls (PCBs).

Analysis of sediments for the above chemical parameters will follow PSEP protocols (PSEP 1997), and results will be reported (by facsimile) within two weeks of sampling to support decisions regarding the need for bioassay testing and TCLP analysis.

The preparation and analysis methods, PSDDA criteria, and MTCA method A criteria are provided in Appendix E. Detection limits of all measured chemicals will be below these criteria. Failure to achieve detection limits below PSDDA screening levels may result in a requirement to reanalyze samples or to perform bioassays. All reasonable means, including additional cleanup steps and method modifications, will be used by the laboratory to achieve detection limits below

PSDDA screening levels. In addition, an aliquot (8 ounces) of each sediment sample submitted for analysis will be archived and preserved at –18°C for additional analysis if necessary.

5.2 Bioassay Analysis

If approved by DGA, the following bioassay testing will be conducted on samples that exceed PSDDA screening levels from one or more sampling sites:

- 10-day marine amphipod toxicity test using *Rhepoxynius abronius*.
- 20-day marine juvenile polychaete toxicity test using *Neanthes arenaceodentata*
- Bivalve larval development toxicity test using the mussel *Mytilus galloprovincialis*.

Bioassays will follow PSEP protocols (PSEP 1997) as follows:

- All reference sediments will be analyzed for total solids, total organic carbon, and grain size.
- Five laboratory replicates of test sediments, reference sediments, and negative controls will be run for each bioassay.
- Cadmium chloride will be used as a reference toxicant for all three bioassays, using standardized concentrations.
- For the *Neanthes* and amphipod bioassays, sacrificial beakers will be used to determine interstitial salinity, ammonia, and sulfides for all test and reference sediments at the beginning and end of the test period. Overlying ammonia and sulfides will be determined at test initiation and termination for the larval test.
- Water quality monitoring will be conducted, consisting of daily measurements of salinity, temperature, pH, and dissolved oxygen for the amphipod and sediment larval bioassays, and measurements every three days for the *Neanthes* test. Monitoring will be conducted for all test and reference sediments and negative controls (including seawater controls). Parameter measurements must be within the limits specified for each bioassay by PSEP (1997).

Test interpretations will consist of endpoint comparisons to the control and reference on an absolute basis, as well as statistical comparison to the reference. Test interpretations and performance standards for the control and reference will follow PSDDA (2000) guidelines (see Appendix E).

6.0 Quality Assurance Plan

The quality assurance plan is applicable to those field and analytical laboratory activities identified above in the sampling and analysis plan. The quality assurance plan describes the policy, organization, and functional activities, as well as the data quality objectives and tasks necessary to provide data of high quality.

6.1 Quality Assurance Responsibilities

The organization and responsibilities of key personnel for the sampling and analysis are as follows:

- **Herrera project manager:** Rob Zisette (Herrera)
  - Ensure compliance with the sampling and analysis plan and the quality assurance plan
  - Provide oversight to ensure that project objectives are completed on schedule and within budget
  - Act as liaison between agencies and project team members
  - Review field sampling measurements and documentation
  - Review field and laboratory quality control measures.
- **Field operations manager and project quality assurance officer:** Rob Zisette (Herrera)
  - Direct field sampling operations
  - Ensure field compliance with the sampling and analysis plan and the quality assurance plan
  - Review field sampling measurements and documentation
  - Validate quality assurance data
  - Direct corrective actions if necessary.
- **Laboratory operations manager:** Jennifer Stewart (EVS Consultants) and Mary Lou Fox (Analytical Resources, Inc.)
  - Ensure proper sample receipt and custody documentation
  - Ensure that quality control measures and analytical methods are performed in accordance with the quality assurance plan

- Oversee internal audits of quality control procedures
- Review quality control procedures and methods
- Direct corrective actions if necessary.

- **Field sampling personnel:** Kent Easthouse, Susan Meyer, and Keith Roraback (Herrera)

  - Conduct field sampling investigations as directed by the sampling and analysis plan and the quality assurance plan
  - Ensure that all field sampling procedures are followed according to the sampling and analysis plan and the quality assurance plan
  - Ensure proper handling, recording, and transport of samples to the laboratory
  - Implement corrective actions as necessary, and report these to the project manager.

6.2 Quality Assurance Objectives

The primary objective of this quality assurance plan is to develop and implement procedures to provide data of known quality and of acceptable accuracy to characterize sediments from the middle basin of Capitol Lake. This quality assurance plan also provides guidance for documentation of information collected in the field, sample custody, and field quality control samples necessary to meet quality assurance objectives. To meet these objectives, the chemical analysis of sediments will follow PSEP protocols (PSEP 1997) that have been developed for measuring environmental variables in Puget Sound.

The quality of the sediment chemistry data will be assessed through an evaluation of precision, accuracy, and completeness of the data collected. Laboratory-specific quality control limits and detection limits for target analytical parameters are presented in Appendix F. All reporting limits are designed to meet regulatory requirements. Quality control criteria for sample frequency, type, and detection limits will be equivalent to PSDDA level 1 quality assurance.

Specific objectives and procedures for precision, accuracy, representativeness, completeness, and comparability are identified below:

- Precision—Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organic chemical analyses, and through duplicate samples for metals and other inorganic chemical analyses.

Analytical precision is quantitatively expressed as the relative percent difference (RPD) between the MS/MSD or duplicates. Analytical precision measurements will be carried out at a minimum frequency of one per sample batch or one in 20 samples per matrix analyzed, whichever is more frequent.

- Accuracy—Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by analyzing standard reference materials or by spiking samples with known standards (surrogates and/or matrix spikes) and measuring the recovery percentage. Accuracy measurements for sediment samples will be carried out in accordance with PSEP protocols at a minimum frequency of one per sample batch or one in 20 samples per matrix analyzed, whichever is more frequent.

- Representativeness—Representativeness is the extent to which the data reflect the actual contaminant levels present in the samples. Representativeness is assessed through method and field blanks, proper preservation, and handling. Proper sample preservation and handling ensure that sample results reflect the actual sample concentrations.

- Comparability—Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability of the data will be maintained by using PSEP protocols. The use of standard techniques for both sample collection and laboratory analysis ensures the comparability of data collected to both internal data and other data generated.

- Completeness—Completeness is defined as the percentage of measurements made that are judged to be valid measurements. Results will be considered valid if all the precision, accuracy, and representative objectives are met. A target completeness goal for this work will be 90 percent.

6.3 Data Assessment Procedures and Corrective Actions

Field and laboratory results will be assessed by the project quality assurance officer who will take appropriate corrective actions if necessary. Quality control problems and any corrective actions taken will be summarized in a quality assurance worksheet (Appendix G). Analytical data values associated with minor quality control problems will be considered as estimated values and flagged with the letter J. Those values associated with major quality control problems will be rejected and flagged with the letter R. Estimated values may be used for evaluation

purposes, while rejected values will not be used. The following section describes the data assessment procedures for the following quality control elements:

- Completeness
- Methodology
- Holding times
- Detection limits
- Blanks
- Duplicates
- Matrix spikes
- Surrogates
- Control standards.

6.3.1 Completeness

Completeness will be assessed by comparing valid sample data with this quality assurance plan and the chain-of-custody records. Completeness will be calculated by dividing the number of valid values by the total number of values obtained. Samples will be reanalyzed if completeness is less than 95 percent.

6.3.2 Methodology

Methodology will be assessed by examination of the field notebook and laboratory reports for deviations from the sampling and analysis plan and the quality assurance plan. Unacceptable deviations will result in rejected values and will be corrected for any future analyses.

6.3.3 Holding Times

The dates on which analyses are performed will be reported by the laboratories. Holding times will be assessed by comparing analysis dates to sample collection dates. Values that exceed the maximum holding times (see Appendix C) will be flagged as estimates (J), whereas severe exceedances will result in rejected values (R).

6.3.4 Blanks

Preparation blanks will be analyzed with each sample batch, and the results will be reported in each laboratory report. If a blank exceeds two times the detection limit, associated sample values that are less than 5 times the blank value will be flagged as estimates (J).

6.3.5 Detection Limits

Detection limits will be reported in each laboratory report. If proposed detection limits are not met by the laboratory, the laboratory will be requested to reanalyze the samples and/or revise the method, if time permits.

6.3.6 Duplicates

Precision of laboratory duplicate results will be presented in each laboratory report and checked by the quality assurance officer. Precision of laboratory and field duplicate results will be calculated according to the following equation:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of two values
C_2	=	smaller of two values.

Laboratory duplicate results exceeding the objectives will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). If the objectives are severely exceeded (e.g., more than twice the objective), associated values will be rejected (R).

6.3.7 Matrix Spikes

Accuracy of matrix spike results will be presented in each laboratory report and checked by the quality assurance officer. Accuracy of matrix spike results will be calculated according to the following equation:

$$\%R = \frac{(S - U) \times 100\%}{C_{sa}}$$

where:

%R	=	percent recovery
S	=	measured concentration in spike sample
U	=	measured concentration in unspiked sample
C_{sa}	=	actual concentration of spike added.

If the analyte is not detected in the unspiked sample, then a value of zero will be used in the equation.

Results exceeding the objective will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). However, if the percent recovery exceeds 125 and a value is less than the detection limit, the result will not be flagged as an estimate. Nondetected values will be rejected if recovery is less than 30 percent.

6.3.8 Surrogates

Accuracy of surrogate results will be presented in each laboratory report and checked by the quality assurance officer. The percent recovery of surrogates will be equivalent to limits established by the laboratory and accepted by the U.S. EPA. Results exceeding the objective will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J).

6.3.9 Control Standards

Accuracy of control standards will be presented in each laboratory report and checked by the quality assurance officer. Accuracy for these elements will be calculated according to the following equation:

$$\%R = \frac{(M - T) \times 100\%}{T}$$

where:

%R	=	percent recovery
M	=	measured value
T	=	true value.

Results exceeding the objective will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). If the objectives are severely exceeded (e.g., more than twice the objective), then associated values will be rejected (R).

6.3.10 Corrective Actions

Corrective actions will be initiated if control audits result in the detection of unacceptable conditions or data. The project manager, in conjunction with the project quality assurance coordinator, will be responsible for implementing corrective actions. Corrective actions could include the following:

- Identifying the source of the violation
- Reanalyzing samples if holding time criteria allow
- Resampling and analysis
- Evaluation and amending sampling and analytical procedures
- Accepting data, then flagging values to indicate the level of uncertainty that may exist.

6.4 Data Management

Sediment quality data will be entered in a numerical format in a Microsoft® Excel spreadsheet following the quality assurance review. Data flags will be entered using the following coding system:

U = Analyte not detected at specified detection limit
J = Estimated value
R = Rejected value.

All data entry and calculations will be reviewed for possible entry errors. The tabulated data will be presented in the sampling data report.

6.5 Quality Assurance Report

Laboratory reports and data quality assurance worksheets and checklists (see Appendix G) will be included in the sampling data report. Any problems and associated corrective actions taken will be reported. Specific quality assurance information that will be presented in the report includes:

- Changes in the sampling and analysis plan or the quality assurance plan
- Results of performance and system audits
- Significant quality assurance problems and recommended solutions
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and detection limits
- Discussion of whether the quality assurance objectives were met and the resulting impact, if any, on decision-making
- Limitations, if any, on the use of the measurement data.

7.0 Reporting

7.1 Quality Assurance Report

The project quality assurance representative will prepare a quality assurance report based on a quality assurance level 1 review of field sampling and the laboratory analytical data. The laboratory data reports will be incorporated by reference. This report will identify any field and laboratory activities that deviated from the approved sampling plan, the quality assurance plan, or the referenced protocols, and will make a statement regarding the overall validity of the data collected. The quality assurance report will be incorporated into the final project report.

7.2 Final Report

A written report shall be prepared by Herrera documenting all activities associated with collection, compositing, transportation of samples, and testing of samples. The laboratory data reports will be included as appendices. At a minimum, the following will be included in the final report:

- Type of sampling equipment used
- Protocols used during sampling and testing and an explanation of any deviations from the sampling plan protocols
- Descriptions of each sample and photographs that adequately provide a visual representation of the sediments
- Locations where the sediment samples were collected, reported in latitude and longitude to the nearest tenth of a second
- A plan view of the project showing the actual sampling locations
- Chain-of-custody procedures used, and explanation of any deviations from the sampling plan procedures
- Description of sampling and compositing procedures
- Final quality assurance report for section 7.1 above
- All raw data required for Dredged Analysis Information System (DAIS), as identified in Appendix H.

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APPENDIX A

1994 Sediment Characterization Results (Entranco 1994)

DRAFT

Capitol Lake Sediment Characterization Report

SUMMARY AND CONCLUSIONS

As part of the Capitol Lake Sediment Control Project, twenty sediment samples were collected in the middle basin of the lake and six sediment samples were collected in the middle basin sediment dewatering site. The purpose of the sediment characterization study was to determine whether the sediments are contaminated by any toxic substances. The sediment sampling sites were chosen to represent the various sectors of the dredge areas in the middle basin and the dredge spoil dewatering area. Samples were not collected near the shoreline, because this area will not be dredged. The results of the sediment study are:

- Total petroleum hydrocarbon (TPH) levels were below the Thurston County High Risk Waste guidelines for the disposal of lake sediments. There currently are no state standards for TPH in sediments.

- Contamination from PCB was not detected in any sample.

- Selected sediment metals were analyzed using the following three separate procedures:

  1) **The Toxicity Characteristic Leaching Procedure (TCLP)** - The TCLP was used to determine the potential of lake sediments to leach toxic materials. Twenty six samples were analyzed using the TCLP for all parameters. All samples had metal concentrations that were below the Maximum Allowable Concentrations for the State of Washington Dangerous Wastes Regulations and the Thurston County Guidelines for High Risk Wastes.

  2) **Total metals concentrations of the bulk sediments** - Five samples were analyzed for the total metal levels in the sediments. Not all metals adsorbed to sediment particles are available to be leached into the water column. The bulk analysis indicated that the sediment concentrations for metals were generally near average and median background concentrations for Washington State lakes, and were well below the "Severe effect level" criteria - the level at which harm has been demonstrated for most benthic (bottom-dwelling) organisms. There currently are not state standards for freshwater sediments.

  3) **Elutriate testing for metals and nitrate** - The purpose of the elutriate analysis was to determine if State of Washington Water Quality Standards for water quality would be exceeded during the disturbance caused by the sediment removal operations. The analysis conducted for this study indicated that none of the standards for the selected metals measured in this study would be exceeded during dredging operations.

TABLE OF CONTENTS

INTRODUCTION

The purpose of this memorandum is to present results of the sediment characterization study performed as part of the Capitol Lake Sediment Control Project. The methods used to handle and dispose of the dredged material may be affected by the chemical characteristics of the sediments. The objectives of the sediment sampling effort were to determine 1) the physical characteristics of the sediments for geotechnical analysis and 2) whether the sediments are contaminated by any toxic substances. This report presents results of the chemical analysis only, the physical characteristics of the sediments are described elsewhere in the dredging plan.

The sediment sampling sites were chosen to represent the various sectors of the dredge areas in the middle basin and the dredge spoil dewatering area (**Figure 1**). Samples were not collected near the shoreline, because this area will not be dredged. The study methods are described first, followed by the sediment results and conclusions.

METHODS

Ten sediment cores were collected in March 1994 at eight stations in the middle basin (**Figure 1**). A four-foot stainless steel hand sediment coring device (Wildco #2424-A50) with two-inch diameter liner tubes was used to collect the core samples. SCUBA divers collected the core samples. The core liners were made of clear thermoplastic and the endcaps of each tube were made of polyethylene. The cores were processed at the laboratory within 48 hours of collection and holding times were not exceeded (**Attachment A**). Two field duplicate cores were collected to estimate field and laboratory variability. Each core was separated into two approximately four-inch samples representing the top and bottom of the core. The top and bottom samples generally ranged in depth between 1 and 7 inches and 9 to 18 inches, respectively (**Table 1**).

In addition, six samples were collected at two stations in February 1994 from the dredge material dewatering area. The stations were located at opposite ends of the dredge material dewatering area (**Figure 1**) and sampled up to a depth of 6.5 feet (**Table 1**). The sediments were placed directly into pre-cleaned glass jars provided by Amtest, Inc.

The samples were analyzed for selected metals, organic compounds (total petroleum hydrocarbons and polychlorinated biphenyl), and total solids. The parameters and methods are listed in **Table 1**. Three types of analysis were conducted to characterize the sediment metals.

1) **The Toxicity Characteristic Leaching Procedure (TCLP)** - The TCLP is used to estimate the concentrations of metals that would become available (not adsorbed on to sediment particles) and leach into groundwater if the dredge spoils were disposed in a landfill. Therefore, the potential metal toxicity of the lake sediments can be evaluated using the TCLP. This procedure complies with the Washington State Department of Ecology's Dangerous Waste Regulations (WAC 173-303-100) and Thurston County's Environmental Health guidelines for the disposal of dredge spoils. The Thurston County Health Officer must authorize the disposal of high risk wastes as outlined in Article V of the Thurston County Sanitary Code, Section 24. All samples were analyzed using the TCLP as indicated in **Table 1**.

A lower detection limit for lead is required to determine compliance with Thurston County Guidelines for High Risk Wastes as compared with Washington State Department of Ecology's Dangerous Waste Regulations. (Thurston County's guidelines are one hundred times lower - 0.05 mg/L versus 5 mg/L for Washington State's Regulations). Therefore, all samples from the middle basin were also analyzed using the method with a lower detection for lead than normally used for the TCLP. The higher detection limits are appropriate only for determining compliance with the Washington State Department of Ecology's Dangerous Waste Regulations and should not be used to determine compliance with Thurston County's guidelines .

2) **Total metals concentrations of the bulk sediments** - Although there currently are no sediment *standards* based on the total concentration (bulk analysis) of sediment metals, the Washington State Department of Ecology (Ecology) is in the process of developing such standards and comparisons of sediment quality are frequently made on the basis of total sediment concentration. Three samples from the middle basin and two samples (19 percent of the total samples) from the dredge spoil dewatering area were selected for bulk analysis and elutriate testing (see additional discussion below) of selected metals (**Table 1**). The stations with higher metals, as determined from the TCLP analysis, were selected for these additional tests. An acid digestion procedure (EPA 3010) was used to extract the sediment metals for bulk analysis. Results are compared against available *criteria* from Ecology (**Ecology 1991**)

3) **Elutriate testing for metals and nitrate** - The purpose of the elutriate analysis was to determine whether the State of Washington Water Quality Standards for Toxic Substances (WAC 173-201A-040) for metals would be exceeded by the disturbance caused during the dredging operations. Five sediments samples were selected for additional analysis for total and dissolved fractions (**Table 1**). The elutriates were generated by combining three parts of lake water, taken from Capitol Lake, with one part sediment. This mixture was aerated for a period of one hour and allowed to settle overnight. A portion of the elutriate was filtered through a 0.45 micron filter in order to obtain the "Dissolved Metals" fraction. Samples of the "background" lake water were also analyzed for metals (arsenic, cadmium, copper, lead, mercury, and zinc), hardness, and nitrate+nitrite-nitrogen.

Table 1
Sample Depths and Analysis of Sediment Samples Collected in Capitol Lake

Station	Sample Depths (Inches)	TCLP[a]	Bulk Sediment and Elutriate Testing[b]
Middle Basin			
1B (Dup)	2 - 6 and 14 -18	■	■
1B	2 - 6 and 13.5 - 17.5	■	
2-1	2 - 6 and 18 - 23	■	
2-2	0 - 4 and 4 - 8	■	
3-1	1 - 8 and 9 -16	■	
3-2	1 - 7 and 8 -13	■	■
4-1	1 - 7 and 10 - 16	■	
4-1 (Dup)	1 - 6 and 7 -13	■	
5-1	1-7 and 10 - 15	■	■
5-3	1 -7 and 10 - 15	■	
Middle Basin Sediment Dewatering Site			
TP-4-1	1 foot	■	
TP-4-3	3 feet	■	
TP-4-6.5	6.5 feet	■	■
HA-5-1.5	1.5 feet	■	
HA-5-3-	3 feet	■	■
HA-5-6.5	6.5 feet	■	

a. Includes the following metals: As, Cd, Cu, Pb, Hg, Zn, and the following parameters: TPH, percent solids, PCB.

b. Includes the following parameters: hardness, NO2+NO3-N, metals (As, Cd, Cu, Pb, Hg, Zn, both total and dissolved).

Table 2
Analytical Methods and Detection Limits for Metals

	TCLP		Elutriate		Total Sediment	
Parameter	Method	Detection Limit ug/L	Method	Detection Limit ug/L	Method	Detection Limit ug/g
Arsenic	1310 SW-846	30	206.2 EPA	1	6010 SW-846	3.0
Cadmium	1310 SW-846	50	200.7 EPA	2	6010 SW-846	0.20
Lead [a)]	1310 SW-846 239.2 EPA	100 1	239.2 EPA	1	6010 SW-846	2.0
Mercury	1310 SW-846	1	245.1 EPA	0.2	7470 SW-846	0.020
Copper	1310 SW-846	20	200.7 EPA	2	6010 SW-846	0.20
Zinc	1310 SW-846	10	200.7 EPA	2	6010 SW-846	0.20

Remaining Parameters

Parameter	Method	Detection Limit
TPH	418.1 EPA	5 ug/g
PCB	8080 SW-846	
Total Solids	2540B SM	
Nitrate+nitrite-nitrogen	353.2.EPA	10 ug/L
Hardness	130.2 EPA	1 mg/L

EPA: 1983: Methods for Chemical Analysis of Water and Wastes
SM: 1992: Standard Methods for the Examination of Water and Wastewater, 18th ed.
SW-846: Test methods for Evaluating Solid Waste Physical/Chemical Methods

[a] To meet the lower detection limits required for Thurston County Guidelines for High Risk Wastes, Method 239.2 EPA was also used for lead analysis for the TCLP. The higher detection limits are appropriate for determining compliance with the Washington State Department of Ecology's Dangerous Waste Regulations. Thurston County Guidelines for High Risk Wastes, however, require detection limits that are less than 50 ug/L.

SEDIMENT QUALITY RESULTS AND DISCUSSION

The sediment data are evaluated on the basis of comparisons with standards and/or criteria and the likelihood of contamination. Some of the sediment or water quality criteria are not directly applicable, but are used in this study to determine the level of contamination, if any, and to allow comparison with background conditions or other studies. Results for the organic parameters, TPH and PCB, are presented first, followed by the three types of metal analysis - TCLP, total sediment metals, and elutriate analysis. The complete sediment data are presented in **Attachment B**.

Total Petroleum Hydrocarbon

Total petroleum hydrocarbon (TPH) represents a fraction of total oil, and the potential nonpoint sources of TPH contributing to lake sediments include urban runoff, boat motors, and contaminated groundwater caused by leakage from underground storage tanks.

The concentrations of sediment TPH in the dewatering area ranged from less than 5 ug/g (dry weight) at the surface of the southern station to approximately 74 ug/g at the lower depths of the northern station. All of the samples within the dewatering area are well below the Thurston County High Risk Waste guideline of 200 mg/kg (equal to ug/g). There currently are no state standards or criteria for freshwater sediment TPH's.

In general, TPH values were similar throughout the middle basin of the Capitol Lake. The average (and standard deviation) TPH concentration in the middle basin was 49 ± 17 ug/g. The highest level measured in the lake was 91 ug/g at the surface of the southernmost station, 1-B-T (**Figure 1**). Therefore, the sediments of the middle basin of Capitol Lake have acceptable levels of TPH and should not require special precautions for handling or disposal.

Polychlorinated biphenyl (PCB)

Polychlorinated biphenyl (PCB) is particularly persistent in the environment and is almost entirely generated by human activity. Sources of PCB include spills and leakage of products containing PCBs, such as electrical equipment (transformers) used in urban areas.

The sediments of Capitol Lake showed no evidence of PCB contamination as all 26 samples were below the detection limit (ATTACHMENT B). The detection limit for the fractions of PCB, which varies as a function of soil moisture and sample size, varied from 52 ug/kg to 310 ug/kg as dry weight.

Metal Analysis

Toxicity Characteristic Leaching Procedure (TCLP)

The intent of the TCLP is to estimate the potential of proposed landfill wastes to leach toxic material. The TCLP reflects the concentrations in an extracted volume and not the total concentrations in the sediment. For this study, the TCLP is used to determine whether the levels of metals in Capitol Lake sediments satisfy the State of Washington's Dangerous Waste Regulations (WAC 173-303-100) and Thurston County's Environmental Health guidelines for the disposal of lake sediments. The high risk waste level for the Thurston County guidelines is found by dividing the Dangerous Waste (DW) TCLP standard by 100. For example, the Dangerous Waste TCLP standard for lead is 5 mg/L and the high risk waste level is 0.05 mg/L. The Thurston County Health Officer must authorize the disposal of high risk waste.

The State of Washington Dangerous Waste Regulations specify that a waste (such as the lake sediments) would exhibit toxicity if it contains contaminants equal to or greater than the DW values (refer to **Table 3**). Any waste which equals or exceeds these levels must comply with applicable requirements of WAC 173-303-100, which establish special precautions for the handling of wastes.

As shown in **Table 3**, all Capitol Lake sediment samples were below the maximum allowable concentration (MAC) for dangerous wastes. All arsenic, cadmium and mercury samples taken from the middle basin of Capitol Lake were below detection limits (**Table 3, Attachment B**). Copper concentrations were also generally below detection limits, with the exception of the surface sample at Station 5-1 and both samples at Station 1-B.

All samples from the middle basin were also below the Thurston County's High Risk guidelines for the disposal of lake sediments (**table 3**). The maximum lead concentration using the TCLP from the middle basin was 19 ug/L, about one-half of Thurston County's High Risk guideline level of 50 ug/L.

On the basis of these results, the sediments would be classified as inert material (likely to retain its physical and chemical structure) and a nondangerous solid wastes for all parameters collected in this study.

Table 3
Results of TCLP Analysis

Parameter	MAC for Dangerous Wastes (mg/L)[1]	High Risk Waste Level (mg/L)[2]	Maximum Concentration from Capitol Lake Sediments (mg/L)	Number of Samples greater or equal to MAC/High Risk Level
Arsenic	5	NA	0.03	0/NA
Cadmium	1	NA	< 0.5	0/NA
Lead	5	0.05	0.019[3]	0/0[3]
Mercury	0.2	NA	0.003	0/NA
Copper	NA	100	0.15	NA/0
Zinc	NA	500	0.12	NA/0

1. MAC: Maximum Contaminant Concentration for dangerous wastes as listed in the Washington State Dangerous Waste Regulations (WAC 173-303-100). Dangerous waste are those wastes designated as dangerous or extremely hazardous under chapter 173-303 WAC, Dangerous Waste Regulations.
2. Thurston County Environmental Health High Risk Waste Evaluation Guidelines: The high risk waste level is found by dividing the Dangerous Waste TCLP standard by 100. For example, the TCLP standard for lead is 5 mg/L, while the high risk waste level is 0.05 mg/L.
3. Comparison of lead levels with Thurston County's High Risk Waste Guidelines apply only to the samples collected in the middle basin.

Total Sediment Metals (Bulk Analysis).

Lake sediments naturally contain concentrations of certain trace metals although the concentration can vary from region to region and lake to lake. Average background concentrations for soil and freshwater sediments in Washington State are shown in **Table 4.** The criteria and guidelines chosen for comparison in this study are based on either the background levels shown in **Table 4** or effects on aquatic organisms.

Ecology has developed and adopted marine sediment *standards*, but has not yet completed development of freshwater sediment *standards*. Ecology has compiled freshwater sediment *criteria* developed from various sources in Canada and the United States (**Ecology 1991**). **Table 4** compares the Capitol Lake sediment results with the available freshwater sediment criteria from the Ontario Ministry of the Environment, which developed guidelines for contaminated sediments based on the chronic and long-term effects on benthic organisms (**Ecology 1991**). The guideline for the "Severe-effect level" is a, "Pronounced disturbance of sediment-dwelling organisms can be expected. Contaminant concentration would be detrimental to the majority of benthic species."

Most sediment metal concentrations in Capitol Lake were near the background levels for lake sediments reported for Washington State. The one exception was copper levels, which were approximately twice background concentrations. As shown in **Table 5**, the lowest effect threshold was equaled or exceeded for arsenic (3 samples), cadmium (2 samples), copper (5 samples), and mercury (2 samples). The severe effect level was not approached by any of the samples. Copper had levels which fell closest to the severe effect level, which were generally one-half this concentration.

Elutriate Test Results

The elutriate test was conducted to evaluate whether sediment removal operations would pollute the water column as a result of sediment resuspension. The elutriate test results for both dissolved and total metal concentrations are shown in **Table 6**. The results of this analysis indicate that none of the freshwater criteria for toxic substances would be exceeded for the metals measured in this study. Note that these criteria are based on the protection of freshwater aquatic life.

Table 4
Comparison between Freshwater Sediment Metals Criteria with Concentrations Measured in Capitol Lake

SAMPLE NUMBERS	As (ug/g)	Cd (ug/g)	Cu (ug/g)	Hg (ug/g)	Pb (ug/g)	Zn (ug/g)	Percent Solids
1-B-B-1	< 2.6	0.6	51	0.2	18.2	63.6	55
3-2-B	6.1	0.8	63	0.1	18.5	72.2	54
5-1-T	13.4	< 0.17	68	0.1	23.4	81.6	38
TP-4-6.5	12.7	0.5	43	0.1	16.5	51.7	60
HA-5-3	< 2.7	< 0.18	63	0.2	26.1	71.7	46
Severe Effect *	33	10	110	2	250	820	
Background Concentrations **							
Mean	6.4	2.6	34	ND	94	220	
Median	3.4	0.5	24	ND	33	84	

All values are reported in dry weight

* Source: Ecology 1991.
** Source: PTI 1989.

Table 5
Elutriate Metals Test Results

SAMPLE NUMBERS		Hardness (mg/L)	NO2+NO3 (ug/l)	As (ug/l)	Cd (ug/l)	Cu (ug/l)	Hg (ug/l)	Pb (ug/l)	Zn (ug/l)
1-B-B-1	Total metals	92	300	< 1	< 2	< 2	< 0.4	1	25
1-B-B-1	Dissolved			< 1	< 2	< 2	< 0.4	< 1	38
3-2-B	Total metals	73	160	2	< 2	3	< 0.4	5	16
3-2-B	Dissolved			1	< 2	< 2	< 0.4	< 1	27
5-1-T	Total metals	65	720	3	< 2	< 2	< 0.4	10	9
5-1-T	Dissolved			1	< 2	< 2	< 0.4	< 1	10
TP-4-6.5	Total metals	940	350	2	16	4	< 0.4	1	54
TP-4-6.5	Dissolved			< 1	< 2	< 2	< 0.4	< 1	65
HA-5-3	Total metals	170	95	1	< 2	12	< 0.4	2	46
HA-5-3	Dissolved			< 1	< 2	3	< 0.4	< 1	44
Lake water	Total metals	30	720	< 1	< 2	< 2	< 0.4	1	3
Lake water	Dissolved			1	< 2	< 2	< 0.4	< 1	2

QUALITY CONTROL RESULTS

As part of routine procedures, the laboratory performed a series of quality control checks. The quality control data were evaluated to determine the precision and accuracy of the sample data. The documentation of the quality assurance and quality control analyses is provided in **Attachment A.**

For the metals analysis, quality control analyses included laboratory duplicates, blanks, standard reference material analysis, and sample spikes at a frequency of ten percent of the samples.

Laboratory Duplicates - Laboratory duplicates for the TCLP analysis of a dewatered sediment sample ranged between 3 percent for arsenic to 75 percent for zinc. The remaining TCLP metals (lead, copper, and mercury) duplicates were approximately 30 to 40 percent. Similarly, the laboratory duplicates for the TCLP analysis of two middle basin sediment sample ranged between 0 percent for lead to 29 percent for zinc. Therefore, the relative percent difference between duplicate samples analyzed occasionally exceeded the control limit of 20 percent on 6 of 12 samples, but this was attributed by the laboratory to the low metals concentrations and the greater relative variability that occurs at these lower levels. The laboratory duplicates for the Capitol Lake elutriate metal samples could not be calculated because one or both samples were below detection limits, with the exception of zinc.

The laboratory duplicates for TPH was less than 20 percent for both of the samples in which this analysis was conducted. Laboratory duplicates for PCB analysis was not conducted as all samples were below detection limits.

Blanks - All blanks for TCLP metals analyses and elutriate metals were below detection limits. The blank values for the total sediment metal for cadmium and copper were 0.4 ug/g and 2.3 ug/g, approximately two and eleven times the detection limit, respectively. This blank for sediment copper is relatively high and concentrations presented in the results section should be viewed as approximate values. The remaining blank values for sediment metals, PCB, and TPH were below the detection limits.

Matrix Spikes - The spike recoveries for PCB, using hexabromobenzene as a surrogate, ranged between 72 and 121 percent, with an average recovery of 92 percent. One value exceeded the acceptable range of 75 to 125 percent. Percent recoveries for the metals (TCLP and elutriate analyses) and TPH were within the control limits. The percent recoveries for the laboratory reference materials were also within the acceptable range.

Standard Reference materials - Standard reference materials for all metals analysis and TPH were within the laboratory control limits (**Attachment A**).

REFERENCES

Brown and Caldwell. 1984. Operations and Maintenance Manual for Capitol Lake Dredge Spoils Treatment Site.

Davis, S, S. Berg, and J. Michaud. 1993. Budd Inlet/Deshutes River Watershed Characterization. Part II. Water Quality Study. Thurston County Public Health and Social Services Department. Olympia, WA.

Ecology. 1991. Summary of Criteria and Guidelines for Contaminated Freshwater Sediments. Produced for Ecology's Sediment Management Unit. Compiled by Jon Bennett and Jim Cubbage. Washington State Department of Ecology.

PTI Environmental Services. 1989. Draft Report Sections 1-7, Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State. Washington Department of Ecology. Olympia, WA.

Tetra Tech, Inc. 1986. Puget Sound Protocols. U.S. EPA document

Thurston County Department of Environmental Health Division, Public Health and Social Services Department 1991. High Risk Waste Evaluation Guidelines. Olympia Washington.

US Environmental Protection Agency 1983. Methods for Chemical Analysis of Water and Wastes

ATTACHMENT A

Quality Assurance/Quality Control Data

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

March 16, 1994

Adolphson and Associates Inc.
attn. Lisa Adolphson
5309 Shilshole Ave. NW
Seattle, WA 98107

Dear Lisa,

Enclosed you will find the analytical results for the first set of sediment samples collected from the Capital Lake Dredging project (# 92055-2). On the 24th of February, Am Test received a total of six (6) samples (sampled 2/23/94) from Hong West and Associates.

The samples were received in good condition. At the time of receipt, the samples were logged in and properly maintained prior to their subsequent analyses. Below you will find a listing of the laboratory sample numbers and the corresponding identifications provided on the chain of custody forms.

94-A004330	*TP-4-1*
94-A004331	*TP-4-3*
94-A004332	*TP-4-6.5*
94-A004333	*HA-5-1.5*
94-A004334	*HA-5-3*
94-A004335	*HA-5-6.5*

The samples were analyzed for the following parameters using the analytical methods that are detailed below:

*Nitrate & Nitrite Nitrogen**	*353.2*	*EPA*
Total Petroleum Hydrocarbon	*418.1*	*EPA*
PCB's	*8080*	*SW-846*
TCLP Metals (As, Cd, Cu, Pb, Hg, Zn)	*1310*	*SW-846*
Total Solids	*2540B*	*SM*

** Soluble*

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The analyses were performed within their respective holding times. The results of the Conventional analyses are expressed on an "as received" basis. The total solids content for each of the samples is reported for you convenience. The apparent disparity between the Total Solids content (sample dried at 103 degrees C) and the Moisture content of the TCLP analysis (filtration) is a function of the differences between the two methods.

*Please note that the detection limits, with the exception of the TCLP Metals, are expressed in terms of minimum method detection limits (i.e. IDL*final extract volume/sample weight) as opposed to quantitation limits.*

Following the analytical data, you will find the Quality Control (QC) summary. Information in this section includes the dates of analyses, and the results of the blanks, duplicates and matrix spikes. All of the QC data was within the control limits of the laboratory, as well as those of the analytical methods.

The data has been reviewed for completeness, accuracy and release. If you have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Mark A. Fugiel
Technical Director
Am Test Inc.

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

March 24, 1994

Adolphson and Associates Inc.
attn. Lisa Adolphson
5309 Shilshole Ave. NW
Seattle, WA 98107

Dear Lisa,

Enclosed you will find the analytical results for the second set of sediment samples collected from the Capital Lake Dredging project (# 92055-2). On the 10th of March, Am Test received a total of twenty (20) samples from Entranco Engineers.

At the time of receipt, the sample cores were split, homogenized, and transfered into proper containers. They were subsequently logged in and properly maintained prior to their analyses.

Below you will find a listing of the laboratory sample numbers, the corresponding client identifications, and the sample depths (inches) that were provided on the chain of custody forms.

94-A005105	1-B-T-1	2-6"
94-A005106	1-B-B-1	14-18"
94-A005107	1-B-T-2	2-6"
94-A005108	1-B-B-2	13-17"
94-A005109	2-1-T	2-6"
94-A005110	2-1-B	18-23"
94-A005111	2-2-T	0-4"
94-A005112	2-2-B	4-8"
94-A005113	3-2-T	1-7"
94-A005114	3-2-B	8-13"
94-A005115	4-1-T-1	1-7"
94-A005116	4-1-B-1	10-16"
94-A005117	4-1-T-2	1-6"
94-A005118	4-1-B-2	7-13"
94-A005119	5-1-T	1-7"
94-A005120	5-1-B	10-15"

AMTEST

94-A005121	5-3-T	1-7"
94-A005122	5-3-B	10-15"
94-A005123	3-1-B	9-16"
94-A005124	3-1-T	1-8"

The samples were analyzed for the following parameters using the analytical methods that are detailed below:

Nitrate & Nitrite Nitrogen*	353.2	EPA
Total Petroleum Hydrocarbon	418.1	EPA
PCB's	8080	SW-846
TCLP Metals (As, Cd, Cu, Pb, Hg, Zn)	1310	SW-846
Total Solids	2540B	Std Methods

* Soluble

The analyses were performed within their respective holding times. The results of the Conventional analyses are expressed on an "as received" basis. The total solids content for each of the samples is reported for you convenience.

The apparent disparity between the Total Solids content (sample dried at 103 degrees C) and the Moisture content of the TCLP analysis (filtration) is a function of the differences between the two methods.

Please note that the detection limits, with the exception of the TCLP Metals, are expressed in terms of minimum method detection limits (IDL*final extract volume/sample weight) as opposed to quantitation limits.

Following the analytical data, you will find the Quality Control (QC) summary. Information in this section includes the dates of analyses, and the results of the blanks, duplicates and matrix spikes. All of the QC data was within the control limits of the laboratory, as well as those of the analytical methods.

The data has been reviewed for completeness, accuracy and

AMTEST

release. If you have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Mark A. Fugiel
Technical Director
Am Test Inc.

AMTEST

AmTest Inc.
Professional
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Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

June 8, 1994

ENTRANCO
JUN 15 1994
RECEIVED

Adolphson and Associates Inc.
attn. Lisa Adolphson
5309 Shilshole Ave. NW
Seattle, WA 98107

Dear Lisa,

Enclosed you will find the analytical results for the metals analyses that were performed on five selected sediments and their corresponding elutriate fractions (Total and Dissolved) from the Capital Lake Dredging project (# 92055-2). The analyses were performed on the same samples that were received from Entranco Engineers in March of this year.

The results of the total metals analyses in the sediments are expressed on an "as received" basis. The method references and the analyses dates are detailed in the Quality Control section of this report.

The elutriates were generated by combining three parts of lake water, taken from Capital Lake, with one part of sediment. This mixture was aerated for a period of one hour and allowed to settle. However, since the particle size of these sediment were extremely small, the elutriates were allowed to settle overnight, as opposed to the typical one hour period that is referenced in the Army Corp procedures. This was necessary in order to obtain a fairly clear resulting solution (Total Metals). A portion of the elutriate was then filtered through a 0.45 micron filter in order to generate the "Dissolved Metals" fraction. Samples of the "background" lake water were also analyzed.

For the elutriates, Arsenic and Lead were analyzed using Graphite Furnace Atomic Absorption (GFAA). The remaining metals (Cadmium, Copper and Zinc), with the exception of Mercury (Cold Vapor), were analyzed by Inductively Coupled Plasma Arc Spectroscopy (ICAP).

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Following the analytical data, you will find the Quality Control (QC) summary. Information in this section includes the dates of analyses, and the results of the blanks, duplicates, matrix spikes and Standard Reference Materials (SRM). All of the QC data was within the control limits of the laboratory, as well as those of the analytical methods.

If you have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Mark A. Fugiel

Mark A. Fugiel
Technical Director
Am Test Inc.

ANALYSIS REPORT AMTEST

Adolfson and Associates, Inc.
Lisa Adolfson

Date Received: 02/25/94
Date Reported: 03/16/94
Project: Capitol Lk Sed Cntl

QUALITY CONTROL - EXTRACTION & ANALYSIS DATES

AM TEST Sample Numbers: 94-A004330 through 94-A004335.

PARAMETERS	DATES
PCB's:	
Extraction	02/28/94
Analysis	03/07/94
Total Petroleum Hydrocarbon	03/04/94
TCLP Metals Extraction	03/10/94
TCLP Metals Analysis:	
Arsenic	03/16/94
Cadmium	03/14/94
Copper	03/14/94
Lead	03/14/94
Mercury	03/11/94
Zinc	03/14/94
Nitrate + Nitrite Nitrogen:	
Extraction	02/25/94
Nitrate	03/08/94
Nitrite	02/25/94
Total Solids	03/04/94

ANALYSIS REPORT AMTEST

Adolfson and Associates, Inc.
Lisa Adolfson

Date Received: 03/10/94
Date Reported: 03/24/94
Project: Capitol Lk Sed

QUALITY CONTROL - EXTRACTION & ANALYSIS DATES

AM TEST Sample Numbers: 94-A005105 through 94-A005124.

PARAMETERS	DATES
PCB's:	
Extraction	03/14/94 - 03/15/94
Analysis	03/16/94
Total Petroleum Hydrocarbon	03/23/94
TCLP Metals Extraction	03/15/94
TCLP Metals Analysis:	
Arsenic	03/16/94
Cadmium	03/16/94
Copper	03/16/94
Lead	03/16/94
Mercury	03/17/94
Zinc	03/16/94
Nitrate + Nitrite Nitrogen:	
Extraction	03/15/94
Nitrate	03/18/94
Nitrite	03/15/94

AMTEST

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METHODOLOGY REPORT

AM TEST ID 94-A008701 MATRIX : Water
CLIENT ID HA-5-3 Elutriate T.M. SAMPLED:

ANALYTE	UNITS	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
Hardness (as CaCO3)	mg/l	130.2	EPA	1.0	5/25/94
Nitrate + Nitrite	mg/l	353.2	EPA	0.010	5/18/94
Arsenic	mg/l	206.2	EPA	0.001	6/ 6/94
Cadmium	mg/l	200.7	EPA	0.002	5/25/94
Copper	mg/l	200.7	EPA	0.002	5/25/94
Mercury	mg/l	245.1	EPA	0.0002	5/19/94
Lead	mg/l	239.2	EPA	0.001	6/ 6/94
Zinc	mg/l	200.7	EPA	0.002	5/25/94
Acid Dig.(Tot Metals)		3010	EPA		5/24/94

SM = Standards Methods for the Examination of Water and Wastewater 18th ed.
SW-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods
EPA = Methods for Chemical Analysis of Water and Wastes 1983

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METHODOLOGY REPORT

AM TEST ID 94-A008695
CLIENT ID HA-5-3

MATRIX : Sediment
SAMPLED:

ANALYTE	UNITS	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
Acid Digestion for Soils		3050	SW-846		5/18/94
Arsenic	ug/g	6010	SW-846	3.0	5/23/94
Cadmium	ug/g	6010	SW-846	0.20	5/23/94
Copper	ug/g	6010	SW-846	0.20	5/23/94
Mercury	ug/g	7470	SW-846	0.020	5/19/94
Lead	ug/g	6010	SW-846	2.0	5/23/94
Zinc	ug/g	6010	SW-846	0.20	5/23/94

SM = Standards Methods for the Examination of Water and Wastewater 18th ed.
SW-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods
EPA = Methods for Chemical Analysis of Water and Wastes 1983

ANALYSIS REPORT AMTEST

Adolfson Associates, Inc.
Lisa Adolfson

Date Received: 05/10/94
Date Reported: 06/08/94
Project: Capitol Lake Sed.
Project No.: 92007-61

QUALITY CONTROL
NBS 2704 - BUFFALO RIVER SEDIMENT
PLASMA SPECTROGRAPHIC ANALYSIS BY EPA METHOD 6010

ELEMENTS		MEASURED VALUE (ug/g)	TRUE VALUE (ug/g)	RECOVERY (%)	DETECTION LIMIT* (ug/g) dry wt.	LABORATORY CONTROL LIMIT** (ug/g)
Arsenic	As	23.6	23.4	100.	3.0	33 - 9.9
Cadmium	Cd	3.92	3.45	114.	0.2	4.77 - 2.03
Copper	Cu	102.	98.6	103.	0.2	125 - 76.7
Lead	Pb	168.	161.	104.	2.0	200 - 125
Zinc	Zn	432.	438.	99.	0.2	538 - 384

*Based on a sample size of 2.0 grams dry weight.
**Based on two standard deviations of the mean (revised 2/93).

Blanks

Dewatering sample			Middle Basin		Elutriate		Sediments	
TPH	< 5	mg/L	16	mg/L				
TCLP								
Arsenic	< 0.03	mg/L	< 0.03	mg/L	< 0.001	mg/L	< 0.10	(ug/g)
Cadmium	< 0.05	mg/L	< 0.05	mg/L	< 0.002	mg/L	0.4	(ug/g)
Copper	< 0.02	mg/L	< 0.02	mg/L	< 0.002	mg/L	2.3	(ug/g)
Lead	< 0.10	mg/L	< 0.10	mg/L	< 0.004	mg/L	< 0.10	(ug/g)
Mercury	< 0.001	mg/L	< 0.00	mg/L	< 0.001	mg/L	< 0.01	(ug/g)
Zinc	< 0.01	mg/L	< 0.02	mg/L	< 0.004	mg/L	< 0.20	(ug/g)

Laboratory Duplicates

HA-5-6.5

	Sample Value (ug/L)	Duplicate Value (ug/L)	Relative Percent Difference
TCLP			
Arsenic	34	35	3
Cadmium	< 5	< 5	NC
Copper	140	180	29
Lead	280	170	39
Mercury	3	2	33
Zinc	40	70	75
TPH (ug/g)			
1-B-T-1	29	34	17
4-1-T-1	18	19	6
1-B-T-1			
TCLP			
Arsenic	< 20	< 20	NC
Cadmium	< 50	< 50	NC
Copper	40	30	25
Lead	140	140	0
Mercury	< 1	< 1	NC
Zinc	120	110	8
1-B-B-1			
TCLP			
Arsenic	< 20	< 20	NC
Cadmium	< 50	< 50	NC
Copper	< 20	30	NC
Lead	< 100	< 100	NC
Mercury	< 1	< 1	NC
Zinc	160	120	25
Capitol Lake Water	Total Metals	(ug/L)	
Arsenic	< 1	1	NC
Cadmium	< 2	< 2	NC
Copper	< 2	< 2	NC
Lead	< 0.4	< 0.4	NC
Mercury	1	< 1	NC
Zinc	3	3	0

Capitol Lake
QA/QC
Percent Recovery

Sample	PCB	TPH	As	Cd	Cu	Hg	Pb	Zn
1-B-T-1	99							
1-B-B-1	72	93						
1-B-T-2	80							
1-B-B-2	100							
2-1-T	93							
2-1-B	103							
2-2-T	112							
2-2-B	110							
3-2-T	101							
3-2-B	75							
4-1-T-1	94		100	100	95	100	90	105
4-1-B-1	87	93	104	96	97	100	93	106
4-1-T-2	97							
4-1-B-2	100							
5-1-T	99							
5-1-B	81							
5-3-T	113							
5-3-B	95							
3-1-B	106							
3-1-T								
TP-4-1	120							
TP-4-3	99	92						
TP-4-6.5	115							
HA-5-1.5	121							
HA-5-3	116							
HA-5-6.5	118		104	86	107	93	95	110
Capitol Lake Water			108	98	100	98	84	103
Standard Reference		95	96	102	100	104	90	100

ATTACHMENT B

TCLP, TPH, and PCB Sediment Data

SEDIMENT DATA
CAPITOL LAKE SEDIMENT REMOVAL PROJECT

Sediment Dewatering Area

SAMPLED ON 02/23/94 TCLP METALS AA

SAMPLE NUMBERS	TPH (ug/g)	As (mg/l)	Cd (mg/l)	Cu (mg/l)	Pb (mg/l)	Pb (mg/l)	Hg (mg/l)	Zn (mg/l)	SOLIDS (%)
TP-4-1	<5	<0.03	<0.05	0.04	0.17		<0.001	0.08	60
TP-4-3	<5	<0.03	<0.05	0.04	0.12		<0.001	0.08	60
TP-4-6.5	37	<0.03	<0.05	0.04	0.28		<0.001	0.07	60
HA-5-1.5	22	<0.03	<0.05	<0.02	<0.1		<0.001	0.10	42
HA-5-3	74	0.03	<0.05	0.10	0.43		0.002	0.06	46
HA-5-6.5	53	0.03	<0.05	0.14	0.28		0.003	0.04	51
Middle Basin SAMPLED ON 03/10/94									
1-B-T-1	81	<0.03	<0.05	0.04	0.14	<0.001	<0.001	0.12	32
1-B-B-1	38	<0.03	<0.05	0.03	<0.1	0.004	<0.001	0.16	55
1-B-T-2	67	<0.03	<0.05	<0.02	<0.1	0.003	<0.001	0.09	39
1-B-B-2	24	<0.03	<0.05	<0.02	<0.1	0.005	<0.001	0.04	72
2-1-T	56	<0.03	<0.05	<0.02	<0.1	0.005	<0.001	0.10	52
2-1-B	29	<0.03	<0.05	<0.02	<0.1	<0.001	<0.001	0.07	59
2-2-T	40	<0.03	<0.05	<0.02	<0.1	0.019	<0.001	0.06	58
2-2-B	30	<0.03	<0.05	<0.02	<0.1	0.002	<0.001	0.07	63
3-2-T	35	<0.03	<0.05	<0.02	0.14	0.001	<0.001	0.07	48
3-2-B	41	<0.03	<0.05	<0.02	<0.1	0.003	<0.001	0.04	54
4-1-T-1	38	<0.03	<0.05	<0.02	<0.1	0.004	<0.001	0.06	48
4-1-B-1	53	<0.03	<0.05	<0.02	0.11	0.002	<0.001	0.04	51
4-1-T-2	54	<0.03	<0.05	<0.02	<0.1	0.004	<0.001	0.05	46
4-1-B-2	62	<0.03	<0.05	<0.02	<0.1	0.003	<0.001	0.04	47
5-1-T	34	<0.03	<0.05	0.15	0.11	0.005	<0.001	0.08	38
5-1-B	70	<0.03	<0.05	<0.02	<0.1	0.005	<0.001	0.07	44
5-3-T	64	<0.03	<0.05	<0.02	0.11	<0.001	<0.001	0.06	42
5-3-B	47	<0.03	<0.05	<0.02	0.14	<0.001	<0.001	0.06	45
3-1-B	37	<0.03	<0.05	<0.02	<0.1	0.003	<0.001	0.04	54
3-1-T	71	<0.03	<0.05	<0.02	<0.1	<0.001	<0.001	0.07	41

APPENDIX B

1995 PSDDA Sediment Characterization Results (Fugial 1995 Personal Communication)

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

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October 16, 1995

Entranco Engineers
attn. Jory Oppenheimer
10900 NE 8th St., Suite 300
Bellevue, WA 98004-4405

Dear Jory,

Enclosed you will find the PSDDA analytical data for the Sediment Characterization at Capital Lake (project # 95-180).

On the 22nd of September 1995, Am Test Inc. received seven sediment sample from Entranco Engineers for chemical analysis. At the time of receipt, the sampled were logged-in, stored, and handled in accordance with EPA protocols and the Sampling and Analysis Plan for this project (8/21/95).

Six of the seven samples were prepared for the complete list of the following parameters:

Conventionals
Grain Size
Metals
Phenols
Polyaromatic Hydrocarbons
Chlorinated Aromatics and Aliphatics
Phthalate Esters
Miscellaneous Oxygenated Compounds
Organo-Nitrogen compounds
Pesticides and PCB's
Volatile Organic Compounds

As a result of an insufficient amount of sediment material, the remaining sample was prepared for all of the parameters listed, with the exception of Volatile Organic Compounds, Ammonia, Sulfides, and Total Organic Carbon.

The methods, holding times, QA/QC documentation, and the data

report package reflect the analytical protocols described in "Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound", Puget Sound Estuary Program (PSEP), 1986.

Protocols for Conventional Sediment Variables 3/86
Protocols for Organic Compounds in Sediment and Tissue Samples 12/89
Protocols for Metals in Sediment and Tissue Samples 12/89

Although these documents specifically address environmental analyses in Puget Sound, the majority of the methods are derived from two notable EPA documents:

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW-846, June 1988

"Methods for Chemical Analysis of Water and Wastes", EPA 600/4-82-055, December 1982

The detection limits reported are in accordance with the PSDDA SL values defined in Phase II PSDDA Management Plan Report, September 1989.

The specific information relative to the chemical analyses are summarized in the attached table. The available information includes a listing of the chemical parameters, the reported units, method references, nominal detection limits, and the PSDDA SL's and ML's. A second table addresses the instrument detection limits.

Conventional sediment analyses were performed in accordance with the PSEP documentation. These analyses were performed without any major problems. The Grain Size was performed using Tyler Screens and Hydrometer techniques.

The sediment samples were analyzed using the Total Acid Digestion (TAD) described in the PSEP documentation. Following the bomb

digestion with nitric, hydrochloric, and hydrofluoric acids, the subsequent solutions were analyzed by graphite furnace atomic absorption (GFAA) for Antimony, Arsenic, Silver, and Cadmium. With the exception of Mercury (Cold Vapor), the remaining metals (Copper, Lead, Nickel and Zinc) were analyzed by Inductively Coupled Plasma Emission Spectroscopy (ICP).

In order to obtain the lower limits of detection that were required for the analysis of the Semi-Volatile Organic compounds, two separate 35 gram subsamples were extracted (EPA 3550) and combined prior to the instrumental analysis (final extract volume of 1 ml). All of the samples were subjected to GPC clean-up. The Dichlorobenzenes were included as a part of the Volatile Organic analysis in order to achieve detection limits that were below the PSDDA SL levels.

Separate 35 gram subsamples were extracted (EPA 3540) and analyzed for the Pesticides and PCB's (method 8080). The clean-up techniques documented in the respective analytical procedures (florisil, alumina etc.) were employed in order to reduce any matrix problems (final extract volume of 5 ml). Dual column confirmation was utilized to substantiate the absence of any target compounds.

As a result of relatively high total solids content, of the majority of the samples (range 52-72%), the relationships between the Method Detection Limit (MDL's) and the PSDDA Screening Levels were favorable. None of the MDL's exceeded any of their corresponding PSDDA SL's. However, three of the samples (Stations 3, 8, and 9), had measurable levels of Benzoic Acid that exceeded PSDDA ML's. Station 3 also had measurable levels of Phenol that was in exceedance of PSDDA SL's.

Following the analytical data you will find the quality control summary. Information in this section includes dates of analyses, sample weights, results of standard reference materials, blanks, duplicates and matrix spikes.

For the Organic parameters (Volatiles, Semi-Volatiles, Pesticides and PCB's), the surrogate spike recoveries, the matrix spike recoveries, the matrix spike duplicates and the method blanks were all within acceptable limits as defined by the analytical procedures.

The results of the Standard Reference Material (HS-3) were consistent with those of past analyses. Since this reference material is not certified using the extraction and instrumental methods (GC/MS) of PSEP, data quality assessment is somewhat difficult. I have included the laboratory control limits in order for you to compare the results with past laboratory performances. For the PCB's, SRM 9701 obtained from ERA (Environmental Resource Associates, Arvada, CO) was used. The results of this reference material were well within the advisory limits established by the manufacturer (based on recoveries given the limitations of the EPA methodologies commonly used for PCB's).

As a result of the lack of documented quality control information specific to the Total Acid Digestion (TAD) procedure, a true assessment of the data quality for metals is somewhat difficult. Due to the smaller sample size, the resulting matrix, and the potential for contamination, normal EPA QC criteria (i.e. spike recoveries between 75 and 125%, duplicates within 20% RPD, SRM's between 80 and 120%) will, with a significant data base, eventually be adjusted.

In spite of these limitations, the data quality in terms of the EPA criteria would have to be considered excellent. All of the matrix spikes (% Recovery), duplicates (RPD) and SRM's were within the EPA limits with the exception of Arsenic (77% Recovery) relative to the Standard Reference Material (NBS 2704). However, the Arsenic result for this SRM was within the laboratory control limits (73-124% Recovery).

All of the detection limits for the organic compounds are listed in terms of the specific sample detection limits. This is calculated as a function of the original sample weight, the final volume of the

AMTEST

analyte solution, the moisture content of the sample, the extract dilution, and the instrument detection limit.

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Mark A. Fugiel
Technical Director
Am Test Inc.

AMTEST

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA 98052
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Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017945
CLIENT ID STN 1
9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	63.6			
Total Volatile Solids (%)	4.10			
Total Organic Carbon (%)	1.0			
Ammonia (mg/kg)	94.			
Total Sulfides (mg/kg)	35.			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	0.20
-2,	4.00	0.20
-1,	2.00	0.20
0,	1.00	0.50
+1,	0.50	3.10
+2,	0.25	21.2
+3,	0.125	23.9
+4,	0.063	11.0
+5,	0.032	10.4
+6,	0.016	7.10
+7,	0.008	7.70
+8,	0.004	7.10
+9,	0.002	2.80
+10,	0.001	1.20
>+10,	<0.001	3.50

METALS (MG/KG DRY WEIGHT)				
Antimony	2.3		20	200
Arsenic	3.6		57	700
Cadmium	< 0.24		0.96	10
Copper	28.		81	810
Lead	9.5		66	660
Mercury	0.074		0.21	2
Nickel	29.		140	
Silver	< 0.17		1.2	5
Zinc	53.		160	1,600

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PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017945
CLIENT ID STN 1
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 20		64	640
Acenaphthene	< 20		63	630
Anthracene	< 20		130	1,300
Fluorene	< 20		64	640
Naphthalene	< 20		210	2,100
Phenanthrene	< 20		320	3,200
2-Methylnaphthalene	< 20		67	670
HPAH				
Benzo(a)anthracene	< 20		450	4,500
Benzo(a)pyrene	< 20		680	6,800
Benzo(b)fluoranthene	< 20		800	8,000
Benzo(k)fluoranthene	< 20			
Benzo(ghi)perylene	< 20		540	5,400
Chrysene	< 20		670	6,700
Dibenzo(a,h)anthracene	< 20		120	5,400
Fluoranthene	< 20		630	6,300
Indeno(1,2,3-cd)pyrene	< 20		69	5,200
Pyrene	< 20		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 12		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 6		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 20		3,100	
Butyl benzyl phthalate	< 20		470	
Diethyl phthalate	< 20		97	
Dimethyl phthalate	< 20		160	
Di-n-butyl phthalate	< 20		1,400	
Di-n-octyl phthalate	< 20		6,200	
PHENOLS				
Pentachlorophenol	< 50		100	690
Phenol	< 20		120	1,200
2 Methylphenol	< 10		20	72
4 Methylphenol	< 20		120	1,200
2,4-Dimethylphenol	< 10		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017945
CLIENT ID STN 1
9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	< 99		400	690
Benzyl alcohol	< 12		25	73
Dibenzofuran	< 20		54	540
Hexachlorobutadiene	< 16		29	290
Hexachloroethane	< 20		1400	14,000
N-Nitrosodiphenylamine	< 12		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	63.0			
D-6-Phenol	75.0			
D-5-Nitrobenzene	65.0			
2-Fluorobiphenyl	78.0			
2,4,6-Tribromophenol	93.0			
D14-Terphenyl	91.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	93.0			
D8-Toluene	88.0			
4-Bromofluorobenzene	82.0			
PESTICIDES & PCB's				
Aldrin	< 0.58		10	
Chlordane	< 0.58		10	
DDD	< 0.98		6.9	69
DDE	< 0.78			
DDT	< 2			
Dieldrin	< 0.78		10	
Heptachlor	< 0.58		10	
Lindane	< 0.58		10	
A-1016	< 9.8		130	2,500
A-1221	< 39		Total	Total
A-1232	< 9.8			
A-1242	< 9.8			
A-1248	< 9.8			
A-1254	< 9.8			
A-1260	< 9.8			
SURROGATE (% RECOVERY)				
Hexabromobenzene	75.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017946
CLIENT ID	STN 2
	9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	71.1			
Total Volatile Solids (%)	3.50			
Total Organic Carbon (%)	0.76			
Ammonia (mg/kg)	41.			
Total Sulfides (mg/kg)	20.			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	0.40
-2,	4.00	1.00
-1,	2.00	1.40
0,	1.00	1.10
+1,	0.50	7.70
+2,	0.25	51.1
+3,	0.125	18.0
+4,	0.063	5.80
+5,	0.032	5.50
+6,	0.016	2.00
+7,	0.008	2.20
+8,	0.004	1.50
+9,	0.002	0.70
+10,	0.001	0.40
>+10,	<0.001	1.30

METALS (MG/KG DRY WEIGHT)				
Antimony	3.7		20	200
Arsenic	3.7		57	700
Cadmium	< 0.25		0.96	10
Copper	20.		81	810
Lead	9.6		66	660
Mercury	< 0.028		0.21	2
Nickel	31.		140	
Silver	< 0.14		1.2	5
Zinc	49.		160	1,600

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PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017946
CLIENT ID STN 2
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 19		64	640
Acenaphthene	< 19		63	630
Anthracene	< 19		130	1,300
Fluorene	< 19		64	640
Naphthalene	< 19		210	2,100
Phenanthrene	< 19		320	3,200
2-Methylnaphthalene	< 19		67	670
HPAH				
Benzo(a)anthracene	< 19		450	4,500
Benzo(a)pyrene	< 19		680	6,800
Benzo(b)fluoranthene	< 19		800	8,000
Benzo(k)fluoranthene	< 19			
Benzo(ghi)perylene	< 19		540	5,400
Chrysene	< 19		670	6,700
Dibenzo(a,h)anthracene	< 19		120	5,400
Fluoranthene	< 19		630	6,300
Indeno(1,2,3-cd)pyrene	< 19		69	5,200
Pyrene	< 19		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 11		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 6		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 19		3,100	
Butyl benzyl phthalate	< 19		470	
Diethyl phthalate	< 19		97	
Dimethyl phthalate	< 19		160	
Di-n-butyl phthalate	< 19		1,400	
Di-n-octyl phthalate	< 19		6,200	
PHENOLS				
Pentachlorophenol	< 46		100	690
Phenol	< 19		120	1,200
2 Methylphenol	< 9		20	72
4 Methylphenol	< 19		120	1,200
2,4-Dimethylphenol	< 9		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017946
CLIENT ID STN 2
9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	< 93		400	690
Benzyl alcohol	< 11		25	73
Dibenzofuran	< 19		54	540
Hexachlorobutadiene	< 15		29	290
Hexachloroethane	< 19		1400	14,000
N-Nitrosodiphenylamine	< 11		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	48.0			
D-6-Phenol	57.0			
D-5-Nitrobenzene	44.0			
2-Fluorobiphenyl	69.0			
2,4,6-Tribromophenol	85.0			
D14-Terphenyl	86.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	95.0			
D8-Toluene	82.0			
4-Bromofluorobenzene	78.0			
PESTICIDES & PCB's				
Aldrin	< 0.55		10	
Chlordane	< 0.55		10	
DDD	< 0.92		6.9	69
DDE	< 0.74			
DDT	< 1.8			
Dieldrin	< 0.74		10	
Heptachlor	< 0.55		10	
Lindane	< 0.55		10	
A-1016	< 9.2		130	2,500
A-1221	< 37		Total	Total
A-1232	< 9.2			
A-1242	< 9.2			
A-1248	< 9.2			
A-1254	< 9.2			
A-1260	< 9.2			
SURROGATE (% RECOVERY)				
Hexabromobenzene	71.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
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10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017947			
CLIENT ID	STN 3 9/20/95			
	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	53.2			
Total Volatile Solids (%)	6.10			
Total Organic Carbon (%)	2.5			
Ammonia (mg/kg)	120			
Total Sulfides (mg/kg)	100			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	0.20
-2,	4.00	< 0.1
-1,	2.00	0.40
0,	1.00	0.20
+1,	0.50	0.60
+2,	0.25	3.90
+3,	0.125	9.60
+4,	0.063	22.2
+5,	0.032	18.0
+6,	0.016	16.4
+7,	0.008	11.2
+8,	0.004	7.00
+9,	0.002	2.90
+10,	0.001	1.40
>+10,	<0.001	6.10

METALS (MG/KG DRY WEIGHT)				
Antimony	2.3		20	200
Arsenic	8.1		57	700
Cadmium	< 0.23		0.96	10
Copper	52		81	810
Lead	6.9		66	660
Mercury	0.043		0.21	2
Nickel	36.		140	
Silver	< 0.19		1.2	5
Zinc	68.		160	1,600

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017947
CLIENT ID STN 3
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 24		64	640
Acenaphthene	< 24		63	630
Anthracene	< 24		130	1,300
Fluorene	< 24		64	640
Naphthalene	< 24		210	2,100
Phenanthrene	< 24		320	3,200
2-Methylnaphthalene	< 24		67	670
HPAH				
Benzo(a)anthracene	< 24		450	4,500
Benzo(a)pyrene	74		680	6,800
Benzo(b)fluoranthene	< 24		800	8,000
Benzo(k)fluoranthene	< 24			
Benzo(ghi)perylene	< 24		540	5,400
Chrysene	< 24		670	6,700
Dibenzo(a,h)anthracene	< 24		120	5,400
Fluoranthene	< 24		630	6,300
Indeno(1,2,3-cd)pyrene	< 24		69	5,200
Pyrene	< 24		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 14		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 7		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 24		3,100	
Butyl benzyl phthalate	< 24		470	
Diethyl phthalate	< 24		97	
Dimethyl phthalate	< 24		160	
Di-n-butyl phthalate	< 24		1,400	
Di-n-octyl phthalate	< 24		6,200	
PHENOLS				
Pentachlorophenol	< 59		100	690
Phenol	150		120	1,200
2 Methylphenol	< 12		20	72
4 Methylphenol	< 24		120	1,200
2,4-Dimethylphenol	< 12		29	50

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PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017947
CLIENT ID	STN 3
	9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	2700		400	690
Benzyl alcohol	< 27		25	73
Dibenzofuran	< 24		54	540
Hexachlorobutadiene	< 19		29	290
Hexachloroethane	< 24		1400	14,000
N-Nitrosodiphenylamine	< 14		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	52.0			
D-6-Phenol	65.0			
D-5-Nitrobenzene	59.0			
2-Fluorobiphenyl	75.0			
2,4,6-Tribromophenol	89.0			
D14-Terphenyl	83.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	92.0			
D8-Toluene	78.0			
4-Bromofluorobenzene	83.0			
PESTICIDES & PCB's				
Aldrin	< 0.7		10	
Chlordane	< 0.7		10	
DDD	< 1.2		6.9	69
DDE	< 0.93			
DDT	< 2.3			
Dieldrin	< 0.93		10	
Heptachlor	< 0.7		10	
Lindane	< 0.7		10	
A-1016	< 12		130	2,500
A-1221	< 46		Total	Total
A-1232	< 12			
A-1242	< 12			
A-1248	< 12			
A-1254	< 12			
A-1260	< 12			
SURROGATE (% RECOVERY)				
Hexabromobenzene	76.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017948
CLIENT ID	STN 8
	9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	59.1			
Total Volatile Solids (%)	4.20			
Total Organic Carbon (%)	2.2			
Ammonia (mg/kg)	51.			
Total Sulfides (mg/kg)	71.			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	3.40
-2,	4.00	0.30
-1,	2.00	2.00
0,	1.00	1.70
+1,	0.50	4.70
+2,	0.25	21.2
+3,	0.125	17.4
+4,	0.063	9.10
+5,	0.032	12.3
+6,	0.016	9.10
+7,	0.008	7.60
+8,	0.004	5.20
+9,	0.002	2.00
+10,	0.001	0.90
>+10,	<0.001	3.10

METALS (MG/KG DRY WEIGHT)

Antimony	3.6		20	200
Arsenic	3.6		57	700
Cadmium	< 0.24		0.96	10
Copper	34.		81	810
Lead	6.5		66	660
Mercury	0.047		0.21	2
Nickel	32.		140	
Silver	< 0.12		1.2	5
Zinc	59.		160	1,600

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017948
CLIENT ID STN 8
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 22		64	640
Acenaphthene	< 22		63	630
Anthracene	< 22		130	1,300
Fluorene	< 22		64	640
Naphthalene	< 22		210	2,100
Phenanthrene	< 22		320	3,200
2-Methylnaphthalene	< 22		67	670
HPAH				
Benzo(a)anthracene	< 22		450	4,500
Benzo(a)pyrene	< 22		680	6,800
Benzo(b)fluoranthene	< 22		800	8,000
Benzo(k)fluoranthene	< 22			
Benzo(ghi)perylene	< 22		540	5,400
Chrysene	< 22		670	6,700
Dibenzo(a,h)anthracene	< 22		120	5,400
Fluoranthene	< 22		630	6,300
Indeno(1,2,3-cd)pyrene	< 22		69	5,200
Pyrene	< 22		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 13		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 7		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 22		3,100	
Butyl benzyl phthalate	< 22		470	
Diethyl phthalate	< 22		97	
Dimethyl phthalate	< 22		160	
Di-n-butyl phthalate	< 22		1,400	
Di-n-octyl phthalate	< 22		6,200	
PHENOLS				
Pentachlorophenol	< 56		100	690
Phenol	100		120	1,200
2 Methylphenol	< 11		20	72
4 Methylphenol	< 22		120	1,200
2,4-Dimethylphenol	< 11		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017948
CLIENT ID STN 8
9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	1700		400	690
Benzyl alcohol	< 23.		25	73
Dibenzofuran	< 22		54	540
Hexachlorobutadiene	< 18		29	290
Hexachloroethane	< 22		1400	14,000
N-Nitrosodiphenylamine	< 13		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	62.0			
D-6-Phenol	70.0			
D-5-Nitrobenzene	60.0			
2-Fluorobiphenyl	75.0			
2,4,6-Tribromophenol	94.0			
D14-Terphenyl	82.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	92.0			
D8-Toluene	90.0			
4-Bromofluorobenzene	78.0			
PESTICIDES & PCB's				
Aldrin	< 0.67		10	
Chlordane	< 0.67		10	
DDD	< 1.1		6.9	69
DDE	< 0.89			
DDT	< 2.2			
Dieldrin	< 0.89		10	
Heptachlor	< 0.67		10	
Lindane	< 0.67		10	
A-1016	< 11		130	2,500
A-1221	< 44		Total	Total
A-1232	< 11			
A-1242	< 11			
A-1248	< 11			
A-1254	< 11			
A-1260	< 11			
SURROGATE (% RECOVERY)				
Hexabromobenzene	75.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017949
CLIENT ID	STN 9
	9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	52.2			
Total Volatile Solids (%)	4.70			
Total Organic Carbon (%)	2.1			
Ammonia (mg/kg)	40.			
Total Sulfides (mg/kg)	190			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	1.90
-2,	4.00	1.10
-1,	2.00	2.50
0,	1.00	3.40
+1,	0.50	10.2
+2,	0.25	17.6
+3,	0.125	7.90
+4,	0.063	6.70
+5,	0.032	11.1
+6,	0.016	11.7
+7,	0.008	11.2
+8,	0.004	7.80
+9,	0.002	2.50
+10,	0.001	1.00
>+10,	<0.001	3.50

METALS (MG/KG DRY WEIGHT)				
Antimony	2.4		20	200
Arsenic	3.6		57	700
Cadmium	< 0.24		0.96	10
Copper	36.		81	810
Lead	10.		66	660
Mercury	< 0.038		0.21	2
Nickel	36.		140	
Silver	< 0.19		1.2	5
Zinc	64.		160	1,600

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017949
CLIENT ID STN 9
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 24		64	640
Acenaphthene	< 24		63	630
Anthracene	< 24		130	1,300
Fluorene	< 24		64	640
Naphthalene	< 24		210	2,100
Phenanthrene	< 24		320	3,200
2-Methylnaphthalene	< 24		67	670
HPAH				
Benzo(a)anthracene	< 24		450	4,500
Benzo(a)pyrene	< 24		680	6,800
Benzo(b)fluoranthene	< 24		800	8,000
Benzo(k)fluoranthene	< 24			
Benzo(ghi)perylene	< 24		540	5,400
Chrysene	< 24		670	6,700
Dibenzo(a,h)anthracene	< 24		120	5,400
Fluoranthene	31		630	6,300
Indeno(1,2,3-cd)pyrene	< 24		69	5,200
Pyrene	26		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 15		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 7		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 24		3,100	
Butyl benzyl phthalate	< 24		470	
Diethyl phthalate	< 24		97	
Dimethyl phthalate	< 24		160	
Di-n-butyl phthalate	< 24		1,400	
Di-n-octyl phthalate	< 24		6,200	
PHENOLS				
Pentachlorophenol	< 61		100	690
Phenol	140		120	1,200
2 Methylphenol	< 12		20	72
4 Methylphenol	< 24		120	1,200
2,4-Dimethylphenol	< 12		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017949
CLIENT ID STN 9
9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	1900		400	690
Benzyl alcohol	< 24		25	73
Dibenzofuran	< 24		54	540
Hexachlorobutadiene	< 20		29	290
Hexachloroethane	< 24		1400	14,000
N-Nitrosodiphenylamine	< 15		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	57.0			
D-6-Phenol	67.0			
D-5-Nitrobenzene	61.0			
2-Fluorobiphenyl	73.0			
2,4,6-Tribromophenol	92.0			
D14-Terphenyl	87.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	89.0			
D8-Toluene	71.0			
4-Bromofluorobenzene	91.0			
PESTICIDES & PCB's				
Aldrin	< 0.72		10	
Chlordane	< 0.72		10	
DDD	< 1.2		6.9	69
DDE	< 0.96			
DDT	< 2.4			
Dieldrin	< 0.96		10	
Heptachlor	< 0.72		10	
Lindane	< 0.72		10	
A-1016	< 12		130	2,500
A-1221	< 48		Total	Total
A-1232	< 12			
A-1242	< 12			
A-1248	< 12			
A-1254	< 12			
A-1260	< 12			
SURROGATE (% RECOVERY)				
Hexabromobenzene	139.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017950
CLIENT ID	FD
	9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	72.1			
Total Volatile Solids (%)	2.60			
Total Organic Carbon (%)	1.2			
Ammonia (mg/kg)	43.			
Total Sulfides (mg/kg)	22.			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	< 0.1
-2,	4.00	0.60
-1,	2.00	0.80
0,	1.00	1.20
+1,	0.50	7.10
+2,	0.25	55.6
+3,	0.125	15.7
+4,	0.063	5.50
+5,	0.032	5.60
+6,	0.016	2.00
+7,	0.008	2.50
+8,	0.004	1.80
+9,	0.002	0.70
+10,	0.001	0.30
>+10,	<0.001	0.60

METALS (MG/KG DRY WEIGHT)				
Antimony	2.4		20	200
Arsenic	2.4		57	700
Cadmium	< 0.24		0.96	10
Copper	32		81	810
Lead	9.1		66	660
Mercury	< 0.028		0.21	2
Nickel	31.		140	
Silver	< 0.14		1.2	5
Zinc	57.		160	1,600

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017950
CLIENT ID FD
9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 18		64	640
Acenaphthene	< 18		63	630
Anthracene	< 18		130	1,300
Fluorene	< 18		64	640
Naphthalene	< 18		210	2,100
Phenanthrene	< 18		320	3,200
2-Methylnaphthalene	< 18		67	670
HPAH				
Benzo(a)anthracene	< 18		450	4,500
Benzo(a)pyrene	< 18		680	6,800
Benzo(b)fluoranthene	< 18		800	8,000
Benzo(k)fluoranthene	< 18			
Benzo(ghi)perylene	< 18		540	5,400
Chrysene	< 18		670	6,700
Dibenzo(a,h)anthracene	< 18		120	5,400
Fluoranthene	< 18		630	6,300
Indeno(1,2,3-cd)pyrene	< 18		69	5,200
Pyrene	< 18		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 11		23	230
1,2-Dichlorobenzene	< 3		19	350
1,3-Dichlorobenzene	< 3		170	
1,4-Dichlorobenzene	< 3		26	260
1,2,4-Trichlorobenzene	< 5		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 18		3,100	
Butyl benzyl phthalate	< 18		470	
Diethyl phthalate	< 18		97	
Dimethyl phthalate	< 18		160	
Di-n-butyl phthalate	< 18		1,400	
Di-n-octyl phthalate	< 18		6,200	
PHENOLS				
Pentachlorophenol	< 46		100	690
Phenol	< 18		120	1,200
2 Methylphenol	< 9		20	72
4 Methylphenol	< 18		120	1,200
2,4-Dimethylphenol	< 9		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017950
CLIENT ID	FD
	9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	< 91		400	690
Benzyl alcohol	< 11		25	73
Dibenzofuran	< 18		54	540
Hexachlorobutadiene	< 15		29	290
Hexachloroethane	< 18		1400	-14,000
N-Nitrosodiphenylamine	< 11		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	54.0			
D-6-Phenol	64.0			
D-5-Nitrobenzene	57.0			
2-Fluorobiphenyl	72.0			
2,4,6-Tribromophenol	97.0			
D14-Terphenyl	89.0			
VOLATILE ORGANICS				
Ethylbenzene	< 3		10	50
Tetrachloroethene	< 3		14	210
Trichloroethene	< 3		160	1,600
Xylene	< 3		12	160
SURROGATES (% RECOVERY)				
D4-1,2-Dichloroethane	90.0			
D8-Toluene	76.0			
4-Bromofluorobenzene	83.0			
PESTICIDES & PCB's				
Aldrin	< 0.54		10	
Chlordane	< 0.54		10	
DDD	< 0.9		6.9	69
DDE	< 0.72			
DDT	< 1.8			
Dieldrin	< 0.72		10	
Heptachlor	< 0.54		10	
Lindane	< 0.54		10	
A-1016	< 9		130	2,500
A-1221	< 36		Total	Total
A-1232	< 9			
A-1242	< 9			
A-1248	< 9			
A-1254	< 9			
A-1260	< 9			
SURROGATE (% RECOVERY)				
Hexabromobenzene	74.			

VALUES ARE IN UG/KG DRY WEIGHT

AMTEST

Entranco
Plaza Center Building
10900 NE 8th, suite 300
Bellevue, WA 98004
Attention: Jory Oppenheimer

Date Received: 9/22/95
Date Reported: 10/13/95

Project Name: Capital Lake
Project #: 92007-61

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017951
CLIENT ID	STN 10
	9/20/95

	RESULT	Q	S.L.	M.L.
CONVENTIONALS (DRY WEIGHT)				
Total Solids (%)	71.9			
Total Volatile Solids (%)	3.10			

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION
	4.75	6.10
-2,	4.00	0.30
-1,	2.00	2.50
0,	1.00	2.50
+1,	0.50	8.30
+2,	0.25	35.9
+3,	0.125	27.3
+4,	0.063	10.0
+5,	0.032	5.70
+6,	0.016	< 0.1
+7,	0.008	0.80
+8,	0.004	0.60
+9,	0.002	< 0.1
+10,	0.001	< 0.1
>+10,	<0.001	< 0.1

METALS (MG/KG DRY WEIGHT)				
Antimony	< 1.1	20	200
Arsenic	3.4	57	700
Cadmium	< 0.22	0.96	10
Copper	12.	81	810
Lead	9.9	66	660
Mercury	< 0.028	0.21	2
Nickel	32.	140	
Silver	< 0.14	1.2	5
Zinc	54.	160	1,600

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID	95-A017951
CLIENT ID	STN 10
	9/20/95

	RESULT	Q	S.L.	M.L.
ORGANICS (UG/KG DRY WEIGHT)				
LPAH				
Acenaphthalene	< 19		64	640
Acenaphthene	< 19		63	630
Anthracene	< 19		130	1,300
Fluorene	< 19		64	640
Naphthalene	< 19		210	2,100
Phenanthrene	< 19		320	3,200
2-Methylnaphthalene	< 19		67	670
HPAH				
Benzo(a)anthracene	< 19		450	4,500
Benzo(a)pyrene	< 19		680	6,800
Benzo(b)fluoranthene	< 19		800	8,000
Benzo(k)fluoranthene	< 19			
Benzo(ghi)perylene	< 19		540	5,400
Chrysene	< 19		670	6,700
Dibenzo(a,h)anthracene	< 19		120	5,400
Fluoranthene	< 19		630	6,300
Indeno(1,2,3-cd)pyrene	< 19		69	5,200
Pyrene	< 19		430	7,300
CHLORINATED HYDROCARBONS				
Hexachlorobenzene	< 12		23	230
1,2,4-Trichlorobenzene	< 6		13	64
PHTHALATES				
Bis(2-ethylhexyl)phthalate	< 19		3,100	
Butyl benzyl phthalate	< 19		470	
Diethyl phthalate	< 19		97	
Dimethyl phthalate	< 19		160	
Di-n-butyl phthalate	< 19		1,400	
Di-n-octyl phthalate	< 19		6,200	
PHENOLS				
Pentachlorophenol	< 48		100	690
Phenol	< 19		120	1,200
2 Methylphenol	< 10		20	72
4 Methylphenol	< 19		120	1,200
2,4-Dimethylphenol	< 10		29	50

AMTEST

PSDDA CHEMICALS OF CONCERN

AM TEST ID 95-A017951
CLIENT ID STN 10
9/20/95

	RESULT	Q	S.L.	M.L.
MISCELLANEOUS COMPOUNDS				
Benzoic acid	< 96		400	690
Benzyl alcohol	< 12		25	73
Dibenzofuran	< 19		54	540
Hexachlorobutadiene	< 15		29	290
Hexachloroethane	< 19		1400	14,000
N-Nitrosodiphenylamine	< 12		28	220
SURROGATES (% RECOVERY)				
2-Fluorophenol	59.0			
D-6-Phenol	72.0			
D-5-Nitrobenzene	64.0			
2-Fluorobiphenyl	79.0			
2,4,6-Tribromophenol	108.			
D14-Terphenyl	98.0			
PESTICIDES & PCB's				
Aldrin	< 0.58		10	
Chlordane	< 0.58		10	
DDD	< 0.96		6.9	69
DDE	< 0.77			
DDT	< 1.9			
Dieldrin	< 0.77		10	
Heptachlor	< 0.58		10	
Lindane	< 0.58		10	
A-1016	< 9.6		130	2,500
A-1221	< 38		Total	Total
A-1232	< 9.6			
A-1242	< 9.6			
A-1248	< 9.6			
A-1254	< 9.6			
A-1260	< 9.6			
SURROGATE (% RECOVERY)				
Hexabromobenzene	84.			

VALUES ARE IN UG/KG DRY WEIGHT

APPENDIX C

Sample Containers, Preservation, and Holding Times

Table C-1. Sample Container, Preservation, and Holding Times

Analytes	Container and Sample Size[a]	Recommended Preservative	Holding Time
Grain size	GT, 12 oz	cool (4° C)	6 months
Total solids	GT, 2 oz[b]	cool (4° C) freeze (-18° C)	14 days 6 months
TOC	GT, 2 oz[b]	cool (4° C) freeze (-18° C)	14 days 6 months
Ammonia	GT, 2 oz[b]	cool (4° C)	7 days
Sulfide	GT, 2 oz	5 ml 2N zinc acetate, cool (4° C)	7 days
Petroleum hydrocarbons	GT, 4 oz	cool (4° C)	28 days
Total metals	GT, 8 oz	cool (4° C) freeze (-18° C)	6 months [c] 2 years [c]
Mercury	Teflon or polyethylene, 4 oz	freeze (-18° C)	28 days
Semivolatiles, Pesticides, and PCBs	GT, 8 oz	cool (4° C) freeze (-18° C)	14 days 1 year 40 days after extraction
Volatile organics	GT, 8 oz (2-4 oz jars)	cool (4° C)	14 days
Metals/organics archive	GT, 8 oz	freeze (-18° C)	2 years
Bioassay	GT, 5-32 oz[d]	cool (4° C)	14 days[e]

[a] GT – borosilicate glass with teflon ® (PTFE) caps
[b] Total solids, TOC, and ammonia may be taken from 8 oz total metals container
[c] Except mercury, which is 28 days
[d] Stored with zero head-space
[e] 14 days recommended, 56 days maximum

APPENDIX D

Chain of Custody Form

HERRERA ENVIRONMENTAL CONSULTANTS
2200 Sixth Avenue, Suite 601
Seattle, Washington 98121
(206)441-9080
FAX 441-9108

CHAIN OF CUSTODY RECORD

page ____ of ____

PROJECT NAME	PROJECT NUMBER	CLIENT	ANALYSES REQUESTED
REPORT TO:		COPY TO:	
SAMPLED BY:		DELIVERY METHOD:	
LABORATORY:	REQUESTED COMPLETION DATE:	TOTAL # OF CONTAINERS:	
LAB USE:		# OF CONTAINERS	

SAMPLE ID	DATE	TIME	SAMPLE DESCRIPTION	# OF CONTAINERS

REMARKS:

RELINQUISHED BY (NAME/CO.)	SIGNATURE	DATE/TIME	RECEIVED BY (NAME/CO.)	SIGNATURE	DATE/TIME
RELINQUISHED BY (NAME/CO.)	SIGNATURE	DATE/TIME	RECEIVED BY (NAME/CO.)	SIGNATURE	DATE/TIME

APPENDIX E

PSDDA Chemical and Bioassay Guidelines

Table E-1. Parameters, methods, PSDDA screening level (SL), PSDDA bioaccumulation trigger (BT), PSDDA maximum level (ML), and MTCA Method A cleanup level.

Parameter	Prep Method	Analysis Method	PSDDA SL	PSDDA BT	PSDDA ML	MTCA Method A Cleanup Level
CONVENTIONALS						
Total Solids (%)	---	Pg.17 (2)	---	---	---	---
Total Volatile Solids(%)	---	Pg.20 (2)	---	---	---	---
Total Organic Carbon (%)	---	DOE (3)	---	---	---	---
Total Sulfides (mg/kg)	---	Pg. 32 (2)	---	---	---	---
Ammonia (mg/kg)	---	Plumb 1981 (4)	---	---	---	---
Grain Size	---	*Modified ASTM* with Hydrometer	---	---	---	---
METALS (mg/kg dry weight)						
Antimony	3050 (5)	GFAA (6)	150	150	200	---
Arsenic	3050	GFAA	57	507.1	700	20
Cadmium	*3050*	GFAA	5.1	---	14	0.5
Chromium	3050	ICP (7)	---	---	---	100
Copper	3050	ICP	390	---	1,300	---
Lead	3050	ICP	450	---	1,200	250
Mercury	7471 (8)	7471	0.41	1.5	2.3	1
Nickel	*3050*	ICP	140	370	370	---
Silver	3050	GFAA	6.1	6.1	8.4	---
Zinc	3050	ICP	410	---	3,800	---
PETROLEUM HYDROCARBONS (mg/kg dry weight)						
Gasoline Range	---	NWTPH-HCID (9)	---	---	---	100
Diesel Range	---	NWTPH-HCID (9)	---	---	---	200
Other	---	NWTPH-HCID (9)	---	---	---	200
ORGANICS (µg/kg dry weight)						
LPAH						
Naphthalene	*3540 (10)*	8270 (11)	2,100	---	2,400	---
Acenaphthylene	3540	8270	560	---	1,300	---
Acenaphthene	3540	8270	500	---	2,000	---
Fluorene	3540	8270	540	---	3,600	---
Phenanthrene	3540	8270	1,500	---	21,000	---
Anthracene	3540	8270	960	---	13,000	---
2-Methylnaphthalene	3540	8270	670	---	1,900	---
Total LPAH			5,200	---	29,000	---
HPAH						
Fluoranthene	3540	8270	1,700	4600	30,000	---
Pyrene	3540	8270	2,600	---	16,000	---
Benzo(a)anthracene	3540	8270	1,300	---	5,100	---
Chrysene	3540	8270	1,400	---	21,000	---
Benzofluoranthenes	3540	8270	3,200	---	9,900	---
Benzo(a)pyrene	3540	8270	1,600	3,600	3,600	---
Indeno(1,2,3-c,d)pyrene	3540	8270	600	---	4,400	---
Dibenzo(a,h)anthracene	3540	8270	230	---	1,900	---
Benzo(g,h,i)perylene	3540	8270	670	---	3,200	---
Total HPAH			12,000	---	69,000	---
PAHs (carcinogenic)	3540	8270	---	---	---	1,000
CHLORINATED HYDROCARBONS						
1,3-Dichlorobenzene	3540	8260 (12)	170	1,241	---	---
1,4-Dichlorobenzene	3540	8260	110	120	120	---
1,2-Dichlorobenzene	3540	8260	35	37	110	---
1,2,4-Trichlorobenzene	3540	8270	31	---	64	---
Hexachlorobenzene (HCB)	3540	8270	22	168	230	---

Parameter	Prep Method	Analysis Method	PSDDA SL	PSDDA BT	PSDDA ML	MTCA Method A Cleanup Level
PHTHALATES						
Dimethyl phthalate	3540	8270	1,400	1,400	---	---
Diethyl phthalate	3540	8270	1,200	---	---	---
Di-n-butyl phthalate	3540	8270	5,100	10,220	---	---
Butyl benzyl phthalate	3540	8270	970	---	---	---
Bis(2-ethylhexyl)phthalate	3540	8270	8,300	13,870	---	---
Di-n-octyl phthalate	3540	8270	6,200	---	---	---
PHENOLS						
Phenol	3540	8270	420	876	1,200	---
2 Methylphenol	3540	8270	63	---	77	---
4 Methylphenol	3540	8270	670	---	3,600	---
2,4-Dimethylphenol	3540	8270	29	---	210	---
Pentachlorophenol	3540	8270	400	504	690	---
MISCELLANEOUS EXTRACTABLES						
Benzyl alcohol	3540	8270	57	---	870	---
Benzoic acid	3540	8270	650	---	760	---
Dibenzofuran	3540	8270	540	---	1,700	---
Hexachloroethane	3540	8270	1,400	10,220	14,000	---
Hexachlorobutadiene	3540	8270	29	212	270	---
N-Nitrosodiphenylamine	3540	8270	28	130	130	---
VOLATILE ORGANICS						
Benzene	8260	8260	---	---	---	500
Trichloroethene	8260	8260	160	1,168	1,600	---
Trichloroethylene	8260	8260	---	---	---	500
1,1,1 Trichloroethane	8260	8260	---	---	---	20,000
Tolulene	8260	8260	---	---	---	40,000
Tetrachloroethene	8260	8260	57	102	210	---
Tetrachloroethylene	8260	8260	---	---	---	500
Ethylbenzene	8260	8260	10	27	50	20,000
Methylene chloride	8260	8260	---	---	---	500
Ethylene dibromide	8260	8260	---	---	---	1
Total Xylene	8260	8260	40	---	160	20,000
PESTICIDES & PCBs						
Total DDT	---	---	6.9	50	69	1,000
p,p'-DDE	3540	8081 (13)	---	---	---	---
p,p'-DDD	3540	8081	---	---	---	---
p,p'-DDT	3540	8081	---	---	---	---
Aldrin	3540	8081	10	37	---	---
Chlordane	3540	8081	10	37	---	---
Dieldrin	3540	8081	10	37	---	---
Heptachlor	3540	8081	10	37	---	---
Lindane	3540	8081	---	---	---	1,000
Total PCBs	3540	8081	130	38 (14)	3,100	1,000

1. *Recommended* Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.
2. *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound*, Puget Sound Estuary Program, March, 1986.
3. *Recommended Methods for Measuring TOC in Sediments*, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.
4. Procedures For Handling and Chemical Analysis of Sediment and Water Samples, Russell H. Plumb, Jr., EPA/Corps of Engineers, May, 1981.
5. *Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods.* Method 3050, SW-846, 3rd ed., Vol 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.
6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
8. *Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods.* Method 7471, SW-846, 3rd ed., Vol 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.
9. Washington State Department of Ecology NWTPH-HCID hydrocarbon screening method (Ecology 1997).
10. Soxhlet Extraction - Method 3540, SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
11. GCMS Capillary Column - Method 8270, SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
12. Purge and Trap Extraction and GCMS Analysis - Method 8260, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
13. GCMS Capillary Column - Method 8081, SW-846, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, EPA 1986.
14. Total PCBs BT value is organic carbon normalized (mg/kg oc).

Table E-2. PSDDA Bioassay Performance Standards and Evaluation Guidelines

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C \leq 10\%$	$M_R - M_C \leq 20\%$	$M_T - M_C > 20\%$ and M_T vs M_R SD ($p=.05$) and		$M_T - M_C > 20\%$ and M_T vs M_R SD ($p=.05$) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval	$N_C \div I \geq 0.70$	$N_R \div N_C \geq 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD ($p=.10$) and		$N_T \div N_C < 0.80$ and N_T/N_C vs N_R/N_C SD ($p=.10$) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C \leq 10\%$ and $MIG_C \geq 0.38$	$M_R \leq 20\%$ and $MIG_R \div MIG_C \geq 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD ($p=.05$) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs MIG_R SD ($p=.05$) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

Source: (PSDDA 1998)

M = mortality, N = normals, I = initial count, MIG = mean individual growth rate (mg/individual/day)

SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable

Subscripts: R = reference sediment, C = negative control, T = test sediment

APPENDIX F

Laboratory Specific QA Limits for Target Parameters

F-1 Chemical Testing
F-2 Biological Testing

F-1 Chemical Testing

ANALYTICAL
RESOURCES
INCORPORATED

METHOD REPORTING LIMITS

General Chemistry

Analyte	Water		Soil	
	MDL	RL	MDL	RL
Acidity	NA	1.0 mg/L	NA	NA
Alkalinity	1.88	1.0 mg/L	NA	NA
Ammonia (Auto. Phenate)	NA	0.01 mg/L	NA	0.2 mg/Kg
Ammonia (ISE)		0.05 mg/L	NA	0.5 mg/Kg
BOD	NA	1.0 mg/L	NA	NA
Bromide	NA	0.1 mg/L	NA	1.0 mg/Kg
Cation Exchange Capacity	NA	NA	NA	1.0 meq/100g
Chloride	0.38	1.0 mg/L	NA	10 mg/Kg
Chlorophyll a	NA	0.1 µg/L	NA	NA
Chromium, Hexavalent	0.001	0.01 mg/L	NA	0.2 mg/Kg
COD	1.51	5.0 mg/L	NA	NA
Coliform (total, fecal)	NA	1 CFU/100 mL	NA	NA
Color	NA	5 Pt-Co Units	NA	NA
Conductivity	NA	1.0 µS	NA	1.0 µS
Cyanide	NA	0.004 mg/L	NA	0.1 mg/Kg
Dissolved Oxygen	NA	0.1 mg/L	NA	NA
Fluoride	0.03	0.1 mg/L	NA	1.0 mg/Kg
Formaldehyde	NA	0.1 mg/L	NA	1.0 mg/Kg
Hardness	NA	1.0 mg/L	NA	NA
Iron (II), Ferrous	NA	0.05 mg/L	NA	NA
Nitrate	0.005	0.01 mg/L	NA	0.3 mg/Kg
Nitrite	0.002	0.01 mg/L	NA	0.1 mg/Kg
Nitrate + Nitrite	NA	0.01 mg/L	NA	0.3 mg/Kg
Oil & Grease (FOG)	NA	1.0 mg/L	NA	NA
Oil & Grease (Polar/Non Polar)	NA	1.0 mg/L	NA	100 mg/Kg
Oil & Grease (Aqueous-IR)	NA	0.1 mg/L	NA	NA
pH	NA	0.05	NA	0.05
Phenols	0.01	0.04 mg/L	NA	0.4 mg/Kg
Phosphorous (Total)	0.01	0.016 mg/L	NA	0.16 mg/Kg
Phosphorous (Ortho)	0.002	0.004 mg/L	NA	0.04 mg/Kg
Salinity	NA	0.1 g/Kg	NA	NA
Silicate	NA	0.02 mg/L	NA	0.2 mg/Kg
Sulfide (w/o distilliation)	0.007	0.5 mg/L	NA	5.0 mg/Kg
Sulfide (Acid Volatile)	NA	0.05 mg/L	NA	0.5 mg/Kg
Sulfate	1.16	2.5 mg/L	NA	25 mg/Kg
Sulfite	NA	2.0 mg/L	NA	NA
TKN	0.35	0.5 mg/L	NA	0.5 mg/Kg
TOC	1.14	1.5 mg/L	NA	200 mg/Kg
Total Solids	NA	10 mg/L	NA	0.01%
Total Suspended Solids	NA	1.0 mg/L	NA	NA
Total Dissolved Solids	NA	10 mg/L	NA	NA
Total Volatile Solids	NA	10 mg/L	NA	5.0 mg/Kg
Total Settleable Solids	NA	0.5 mg/L	NA	NA
Turbidity	NA	0.01 NTU	NA	NA

Method Detection Limit (MDL) studies have been performed in accordance with 40 CFR Part 136, Appendix B, using six degrees of freedom, for many of these parameters, however the MDL results have not been used in the determination Reporting Limits (RLs). MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

RLs for wet chemistry parameters are generally accepted to be at the level of the lowest calibration standard. This is an accepted technique for determining RLs.

NA indicates data not available.

02/12/98

METHOD REPORTING LIMITS
HCID by Method 8015

Analyte	Water		Soil		Tissue	
	MDL	RL	MDL	RL	MDL	RL
Gasoline Range Hydrocarbons	NA	10	NA	10	NA	NA
Diesel Range Hydrocarbons	1.4	10	2.8	25	NA	NA
Oil Range Hydrocarbons	NA	25	NA	50	NA	NA
Units:	mg/L		mg/Kg		mg/Kg	

Method Detection Limit (MDL) studies were performed in accordance with 40 CFR Part 136, Appendix B, using degrees of freedom.

MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

Reporting Limit (RL) : The RL is the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the statistical MDL, method efficiency, and analyte response. The RL will, at minimum, equal the statistical MDL (rounded). The RL will exceed the statistical MDL for the more variable analytes or methods.

NA indicates data not available.

Waters revised 07/31/96
Soils revised 04/10/96

02/12/97

H28

ANALYTICAL
RESOURCES
INCORPORATED

Summary of Laboratory Control Limits

HCID
Method HCID (8015M)

	Water	Soil/Sediment
LCS Recoveries		
Diesel	46-141	34-150
Method Blank/LCS Surrogates		
Methyl Arachidate	39-150	47-150
Matrix Spike Recoveries		
Diesel	36-157	38-160
Sample Surrogates		
Methyl Arachidate	32-157	33-160

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SOIL
NORMAL REPORTING LIMITS (mg/kg)
11/1/99

Element	ICP *	GFAA *	ICP-MS **	CVAA ***
Ag	0.30	0.02	0.50	
Al	2.00		20.0	
As	5.00	0.10	0.20	
B	0.60			
Ba	0.30		0.50	
Be	0.10		0.20	
Ca	5.00		50.0	
Cd	0.20	0.02	0.20	
Co	0.30		0.20	
Cr	0.50		0.50	
Cu	0.20		0.50	
Fe	2.00		20.0	
Hg				0.05
K	50.0		20.0	
Li	0.40			
Mg	2.00		20.0	
Mn	0.10		0.50	
Mo	0.50		0.20	
Na	5.00		100.0	
Ni	1.00		0.50	
Pb	2.00	0.10	1.00	
Sb	5.00	0.20	0.20	
Se	5.00	0.20	1.00	
Si	6.00			
Sn	1.00			
Sr	0.10			
Th	3.00		0.20	
Ti	0.50			
Tl	5.00	0.10	0.20	
U	6.00		0.20	
V	0.30		0.20	
W	5.00			
Zn	0.60		4.00	

* Reporting limit assumes 100% solids with a digestion of 1.0 gram sample into a final volume of 100 mL.

** Reporting limit assumes 100% solids with a digestion of 1.0 gram sample into a final volume of 100 mL, followed by a 1/10 dilution before analysis. For "clean" samples dilution may not be required.

*** Reporting limit assumes 100% solids with a digestion of 0.20 gram sample into a final volume of 100 mL. Up to 2.0 grams of sample can be used if lower detection limites are required.

ANALYTICAL RESOURCES INCORPORATED

Summary of Laboratory Control Limits
Metals

	Water	Soil/Sediment
Matrix Spike Recoveries / Duplicate RPDs		
Aluminum	75-125 / ±20%	75-125 / ±20%
Antimony	75-125 / ±20%	75-125 / ±20%
Arsenic	75-125 / ±20%	75-125 / ±20%
Barium	75-125 / ±20%	75-125 / ±20%
Beryllium	75-125 / ±20%	75-125 / ±20%
Boron	75-125 / ±20%	75-125 / ±20%
Cadmium	75-125 / ±20%	75-125 / ±20%
Calcium	75-125 / ±20%	75-125 / ±20%
Chromium	75-125 / ±20%	75-125 / ±20%
Cobalt	75-125 / ±20%	75-125 / ±20%
Copper	75-125 / ±20%	75-125 / ±20%
Iron	75-125 / ±20%	75-125 / ±20%
Lead	75-125 / ±20%	75-125 / ±20%
Magnesium	75-125 / ±20%	75-125 / ±20%
Manganese	75-125 / ±20%	75-125 / ±20%
Mercury	75-125 / ±20%	75-125 / ±20%
Nickel	75-125 / ±20%	75-125 / ±20%
Potassium	75-125 / ±20%	75-125 / ±20%
Selenium	75-125 / ±20%	75-125 / ±20%
Silica	75-125 / ±20%	75-125 / ±20%
Silver	75-125 / ±20%	75-125 / ±20%
Sodium	75-125 / ±20%	75-125 / ±20%
Strontium	75-125 / ±20%	75-125 / ±20%
Thallium	75-125 / ±20%	75-125 / ±20%
Vanadium	75-125 / ±20%	75-125 / ±20%
Zinc	75-125 / ±20%	75-125 / ±20%

METHOD REPORTING LIMITS
PSEP Semivolatiles by Method 8270

Analyte	Water		Sediment		Tissue	
	MDL	RL	MDL	RL	MDL	RL
Phenol	NA	NA	6.4	20	NA	NA
bis(2-Chloroethyl)Ether	NA	NA	6.9	40	NA	NA
2-Chlorophenol	NA	NA	6.3	20	NA	NA
1,3-Dichlorobenzene	NA	NA	7.1	20	NA	NA
1,4-Dichlorobenzene	NA	NA	7.0	20	NA	NA
Benzyl Alcohol	NA	NA	16	20	NA	NA
1,2-Dichlorobenzene	NA	NA	6.2	20	NA	NA
2-Methylphenol	NA	NA	7.6	20	NA	NA
2,2'-Oxybis(1-Chloropropane)	NA	NA	6.5	20	NA	NA
4-Methylphenol	NA	NA	8.9	20	NA	NA
N-Nitroso-Di-n-Propylamine	NA	NA	6.6	40	NA	NA
Hexachloroethane	NA	NA	6.9	20	NA	NA
Nitrobenzene	NA	NA	9.3	20	NA	NA
Isophorone	NA	NA	4.7	20	NA	NA
2-Nitrophenol	NA	NA	9.4	100	NA	NA
2,4-Dimethylphenol	NA	NA	34.7	40 20	NA	NA
Benzoic Acid	NA	NA	10.0	200	NA	NA
bis(2-Chloroethoxy)Methane	NA	NA	5.7	20	NA	NA
2,4-Dichlorophenol	NA	NA	5.3	60	NA	NA
1,2,4-Trichlorobenzene	NA	NA	6.3	20	NA	NA
Naphthalene	NA	NA	4.7	20	NA	NA
4-Chloroaniline	NA	NA	51.6	60	NA	NA
Hexachlorobutadiene	NA	NA	6.1	20	NA	NA
4-Chloro-3-Methylphenol	NA	NA	5.5	40	NA	NA
2-Methylnaphthalene	NA	NA	5.7	20	NA	NA
Hexachlorocyclopentadiene	NA	NA	26.1	100	NA	NA
2,4,6-Trichlorophenol	NA	NA	6.0	100	NA	NA
2,4,6-Trichlorophenol	NA	NA	4.7	100	NA	NA
2-Chloronaphthalene	NA	NA	5.6	20	NA	NA
2-Nitroaniline	NA	NA	29.6	100	NA	NA
Dimethyl Phthalate	NA	NA	3.6	20	NA	NA
Acenaphthylene	NA	NA	5.5	20	NA	NA
3-Nitroaniline	NA	NA	42.0	120	NA	NA
Acenaphthene	NA	NA	5.1	20	NA	NA
2,4-Dinitrophenol	NA	NA	30.2	200	NA	NA
4-Nitrophenol	NA	NA	9.3	100	NA	NA
Dibenzofuran	NA	NA	4.6	20	NA	NA
2,6-Dinitrotoluene	NA	NA	7.2	100	NA	NA
2,4-Dinitrotoluene	NA	NA	7.8	100	NA	NA
Diethylphthalate	NA	NA	4.7	20	NA	NA
4-Chlorophenyl-phenylether	NA	NA	4.1	20	NA	NA
Fluorene	NA	NA	4.4	20	NA	NA
4-Nitroaniline	NA	NA	31.8	100	NA	NA
4,6-Dinitro-2-Methylphenol	NA	NA	99.2	200	NA	NA
N-Nitrosodiphenylamine(1)	NA	NA	11.9	20	NA	NA
Units:	µg/L		µg/Kg		µg/Kg	

METHOD REPORTING LIMITS
PSEP Semivolatiles by Method 8270

Analyte	Water		Soil (Sediment)		Tissue	
	MDL	RL	MDL	RL	MDL	RL
4-Bromophenyl-phenylether	NA	NA	4.4	20	NA	NA
Hexachlorobenzene	NA	NA	7.9	20	NA	NA
Pentachlorophenol	NA	NA	53.6	100	NA	NA
Phenanthrene	NA	NA	3.1	20	NA	NA
Carbazole	NA	NA	5.6	20	NA	NA
Anthracene	NA	NA	6.6	20	NA	NA
Di-n-Butylphthalate	NA	NA	5.0	20	NA	NA
Fluoranthene	NA	NA	6.1	20	NA	NA
Pyrene	NA	NA	6.5	20	NA	NA
Butylbenzylphthalate	NA	NA	6.5	20	NA	NA
3,3'-Dichlorobenzidine	NA	NA	148	200	NA	NA
Benzo(a)Anthracene	NA	NA	4.2	20	NA	NA
bis(2-Ethylhexyl)Phthalate	NA	NA	17.0	20	NA	NA
Chrysene	NA	NA	2.7	20	NA	NA
Di-n-Octyl Phthalate	NA	NA	4.2	20	NA	NA
Benzo(b)Fluoranthene	NA	NA	3.9	20	NA	NA
Benzo(k)Fluoranthene	NA	NA	4.6	20	NA	NA
Benzo(a)Pyrene	NA	NA	5.5	20	NA	NA
Indeno(1,2,3-cd)Pyrene	NA	NA	4.4	20	NA	NA
Dibenz(a,h)Anthracene	NA	NA	5.5	20	NA	NA
Benzo(ghi)Perylene	NA	NA	8.9	20	NA	NA
Pyridine	NA	NA	NA	40	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	100	NA	NA
Aniline	NA	NA	NA	20	NA	NA
Benzidine	NA	NA	NA	200	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	40	NA	NA
N,N-Dimethylaniline	NA	NA	NA	20	NA	NA
N-Methylaniline	NA	NA	NA	20	NA	NA
1,2-Diphenylhydrazine	NA	NA	NA	20	NA	NA
Tributyl Phosphate	NA	NA	NA	20	NA	NA
Dibutyl Phenyl Phosphate	NA	NA	NA	40	NA	NA
Butyl Diphenyl Phosphate	NA	NA	NA	100	NA	NA
Triphenyl Phosphate	NA	NA	NA	100	NA	NA
Units:	µg/L		µg/Kg		µg/Kg	

Method Detection Limit (MDL) studies were performed in accordance with 40 CFR Part 136, Appendix B, using degrees of freedom.

MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

Reporting Limit (RL) : The RL is the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the statistical MDL, method efficiency, and analyte response. The RL will, at minimum, equal the statistical MDL (rounded). The RL will exceed the statistical MDL for the more variable analytes or methods.

NA indicates data not available.

Sediments revised 01/03/96 (F8), 01/08/96 (HP NT1)

4/1/97

Summary of Laboratory Control Limits
GC/MS Semivolatiles
PSDDA/PSEP Sediments

	Water		Soil/Sediment
	Sep. Funnel	Liq./Liq.	
LCS Recoveries			
Phenol	NA	NA	19-116
2-Chlorophenol	NA	NA	15-117
1,4-Dichlorobenzene	NA	NA	22-108
N-nitroso-di-n-propylamine	NA	NA	12-109
1,2,4-Trichlorobenzene	NA	NA	19-111
4-Chloro-3-Methylphenol	NA	NA	24-132
Acenaphthene	NA	NA	25-114
4-Nitrophenol	NA	NA	15-157
2,4-Dinitrotoluene	NA	NA	23-135
Pentachlorophenol	NA	NA	12-112
Pyrene	NA	NA	27-138
Method Blank/LCS Surrogates			
d4-2-Chlorophenol	NA	NA	21-111
d4-1,2-Dichlorobenzene	NA	NA	30-103
Tribromophenol	NA	NA	17-134
2-Fluorophenol	NA	NA	23-110
d5-Phenol	NA	NA	17-108
d5-Nitrobenzene	NA	NA	20-116
2-Fluorobiphenyl	NA	NA	29-107
d14-p-Terphenyl	NA	NA	45-123
d14-dibenz(a,h)anthracene	NA	NA	NA
Matrix Spike Recoveries			
Phenol	NA	NA	51-103
2-Chlorophenol	NA	NA	21-117
1,4-Dichlorobenzene	NA	NA	34-100
N-nitroso-di-n-propylamine	NA	NA	49-102
1,2,4-Trichlorobenzene	NA	NA	31-100
4-Chloro-3-Methylphenol	NA	NA	55-138
Acenaphthene	NA	NA	33-116
4-Nitrophenol	NA	NA	44-190
2,4-Dinitrotoluene	NA	NA	41-151
Pentachlorophenol	NA	NA	10-128
Pyrene	NA	NA	10-177
Sample Surrogates			
d4-2-Chlorophenol	NA	NA	24-100
d4-1,2-Dichlorobenzene	NA	NA	17-100
Tribromophenol	NA	NA	31-110
2-Fluorophenol	NA	NA	21-100
d5-Phenol	NA	NA	24-100
d5-Nitrobenzene	NA	NA	25-100
2-Fluorobiphenyl	NA	NA	30-101
d14-p-Terphenyl	NA	NA	24-126
d14-dibenz(a,h)anthracene	NA	NA	NA

METHOD REPORTING LIMITS
Organochlorine Pesticides - PSDDA/PSEP

Analyte	Water		Sediment		Tissue	
	MDL	RL	MDL	RL	MDL	RL
Alpha-BHC	NA	NA	0.034	1.0	NA	NA
Beta-BHC	NA	NA	0.047	1.0	NA	NA
Gamma-BHC (Lindane)	NA	NA	0.040	1.0	NA	NA
Delta-BHC	NA	NA	0.056	1.0	NA	NA
Heptachlor	NA	NA	0.031	1.0	NA	NA
Aldrin	NA	NA	0.039	1.0	NA	NA
Heptachlor Epoxide	NA	NA	0.051	1.0	NA	NA
Endosulfan I	NA	NA	0.060	1.0	NA	NA
DDE	NA	NA	0.077	2.0	NA	NA
Dieldrin	NA	NA	0.084	2.0	NA	NA
Endrin	NA	NA	0.081	2.0	NA	NA
Endosulfan II	NA	NA	0.103	2.0	NA	NA
DDD	NA	NA	0.125	2.0	NA	NA
Endrin Aldehyde	NA	NA	0.090	2.0	NA	NA
DDT	NA	NA	0.098	2.0	NA	NA
Endosulfan Sulfate	NA	NA	0.145	2.0	NA	NA
Endrin Ketone	NA	NA	0.174	2.0	NA	NA
Methoxychlor	NA	NA	0.586	10	NA	NA
Gamma-chlordane	NA	NA	0.044	1.0	NA	NA
Alpha-chlordane	NA	NA	0.060	1.0	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA
Units:	µg/L		µg/Kg		µg/Kg	

Method Detection Limit (MDL) studies were performed in accordance with 40 CFR Part 136, Appendix B, using six degrees of freedom.

MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

Reporting Limit (RL) : The RL is the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the statistical MDL, method efficiency, and analyte response. The RL will, at minimum, equal the statistical MDL (rounded). The RL will exceed the statistical MDL for the more variable analytes or methods.

NA indicates data not available.

Sediments revised 11/15/94

2/12/97

ANALYTICAL
RESOURCES
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METHOD REPORTING LIMITS
Aroclors/Polychlorinated Biphenyls - PSDDA/PSEP

Analyte	Water		Sediment		Tissue		Oil	
	MDL	RL	MDL	RL	MDL	RL	MDL	RL
Aroclor 1016	NA	NA	4.83	10	NA	NA	NA	NA
Aroclor 1221	NA	NA	4.02	20	NA	NA	NA	NA
Aroclor 1232	NA	NA	4.17	10	NA	NA	NA	NA
Aroclor 1242	NA	NA	1.31	10	NA	NA	NA	NA
Aroclor 1248	NA	NA	8.14	10	NA	NA	NA	NA
Aroclor 1254	NA	NA	1.26	10	NA	NA	NA	NA
Aroclor 1260	NA	NA	2.34	10	NA	NA	NA	NA
Aroclor 1262	NA	NA	2.11	10	NA	NA	NA	NA
Aroclor 1268	NA	NA	4.80	10	NA	NA	NA	NA
Units:	ug/L		ug/Kg		ug/Kg		ug/Kg	

Method Detection Limit (MDL) studies were performed in accordance with 40 CFR Part 136, Appendix B, using six degrees of freedom.

MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

Reporting Limit (RL) : The RL is the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the statistical MDL, method efficiency, and analyte response. The RL will, at minimum, equal the statistical MDL (rounded). The RL will exceed the statistical MDL for the more variable analytes or methods.

NA indicates data not available.

Sediment revised 2/24-2/26/97

3/12/97

A21

Summary of Laboratory Control Limits
Organochlorine Pesticides
Method 8081

	Water	Soil/Sediment
LCS Recoveries		
Lindane	38-144	37-143
Heptachlor	35-109	42-124
Aldrin	33-109	40-121
Dieldrin	52-145	43-133
Endrin	44-136	37-140
DDT	55-142	46-135
Method Blank/LCS Surrogates		
Tetrachlorometaxylene (TCMX)	30-102	36-115
Decachlorobiphenyl (DCBP)	30-135	39-127
Matrix Spike Recoveries		
Lindane	38-154	30-140
Heptachlor	32-128	35-122
Aldrin	30-145	30-128
Dieldrin	40-141	38-132
Endrin	41-148	30-136
DDT	42-146	42-139
Sample Surrogates		
Tetrachlorometaxylene (TCMX)	41-121	46-131
Decachlorobiphenyl (DCBP)	45-139	54-138

ANALYTICAL
RESOURCES
INCORPORATED

Summary of Laboratory Control Limits
PCBs/Aroclors
Method 8081

	Water	Soil/Sediment	Oil	Wipe
LCS Recoveries				
Aroclor 1242	30-160	40-129	30-160	30-150
Method Blank/LCS Surrogates				
Tetrachlorometaxylene (TCMX)	30-118	34-142	30-160	30-150
Decachlorobiphenyl (DCBP)	30-160	63-146	30-160	30-150
Matrix Spike Recoveries				
Aroclor 1242	30-160	30-160	30-160	30-160
Sample Surrogates				
Tetrachlorometaxylene (TCMX)	30-103	33-134	30-111	42-120
Decachlorobiphenyl (DCBP)	30-128	43-155	36-140	59-132

* - indicates a PSDDA or MTCA compound

METHOD REPORTING LIMITS
Volatiles by Method 8260

RL
* Ethylene Dibromide 1.0ppb ↓

Analyte	Water		Soil		Tissue	
	MDL	RL	MDL	RL	MDL	RL
Chloromethane	0.57	2.0	1.1	2.0	NA	NA
* Vinyl Chloride	0.51	2.0	0.68	2.0	NA	NA
Bromomethane	1.1	2.0	0.85	2.0	NA	NA
Chloroethane	0.38	2.0	1.0	2.0	NA	NA
Trichlorofluoromethane	0.40	2.0	0.91	2.0	NA	NA
Acrolein	4.0	50	38	50	NA	NA
Acetone	2.9	5.0	3.8	5.0	NA	NA
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.42	2.0	1.5	2.0	NA	NA
* 1,1-Dichloroethene	0.47	1.0	0.89	1.0	NA	NA
Bromoethane	0.57	2.0	0.57	2.0	NA	NA
Iodomethane	1.1	1.0	1.3	1.0	NA	NA
* Methylene Chloride	0.54	2.0	2.1	2.0	NA	NA
Carbon Disulfide	0.39	1.0	0.44	1.0	NA	NA
Acrylonitrile	1.2	5.0	0.55	5.0	NA	NA
* trans-1,2-Dichloroethene	0.44	1.0	0.47	1.0	NA	NA
Vinyl Acetate	0.56	5.0	3.2	5.0	NA	NA
1,1-Dichloroethane	0.43	1.0	0.52	1.0	NA	NA
Butanone	2.8	5.0	4.0	5.0	NA	NA
2,2-Dichloropropane	0.72	1.0	0.55	1.0	NA	NA
* cis-1,2-Dichloroethene	0.34	1.0	0.56	1.0	NA	NA
Chloroform	0.46	1.0	0.59	1.0	NA	NA
Bromochloromethane	0.44	1.0	0.60	1.0	NA	NA
* 1,1,1-Trichloroethane	0.36	1.0	0.49	1.0	NA	NA
1,1-Dichloropropene	0.37	1.0	0.76	1.0	NA	NA
Carbon Tetrachloride	0.25	1.0	0.71	1.0	NA	NA
* 1,2-Dichloroethane	0.37	1.0	0.66	1.0	NA	NA
* Benzene	0.25	1.0	0.74	1.0	NA	NA
* Trichloroethene	0.35	1.0	0.71	1.0	NA	NA
1,2-Dichloropropane	0.51	1.0	0.71	1.0	NA	NA
Bromodichloromethane	0.33	1.0	0.52	1.0	NA	NA
Dibromomethane	0.68	1.0	0.48	1.0	NA	NA
2-Chloroethyl Vinyl Ether	0.65	5.0	1.4	5.0	NA	NA
4-Methyl-2-Pentanone	2.3	5.0	4.0	5.0	NA	NA
cis-1,3-Dichloropropene	0.42	1.0	0.86	1.0	NA	NA
* Toluene	0.45	1.0	1.0	1.0	NA	NA
trans-1,3-Dichloropropene	0.50	1.0	0.79	1.0	NA	NA
1,1,2-Trichloroethane	0.49	1.0	0.75	1.0	NA	NA
1,2-Dibromoethane	0.37	1.0	0.91	1.0	NA	NA
2-Hexanone	2.8	5.0	5.4	5.0	NA	NA
1,3-Dichloropropane	0.24	1.0	0.63	1.0	NA	NA
* Tetrachloroethene	0.30	1.0	0.88	1.0	NA	NA
Chlorodibromomethane	0.25	1.0	0.45	1.0	NA	NA
Chlorobenzene	0.23	1.0	0.78	1.0	NA	NA
1,1,1,2-Tetrachloroethane	0.39	1.0	0.58	1.0	NA	NA
* Ethyl Benzene	0.29	1.0	0.75	1.0	NA	NA
Units:	µg/L		µg/Kg		µg/Kg	

METHOD REPORTING LIMITS
Volatiles by Method 8260

Analyte	Water MDL	Water RL	Soil MDL	Soil RL	Tissue MDL	Tissue RL
m,p-Xylene	0.41	1.0	1.8	2.0	NA	NA
o-Xylene	0.24	1.0	1.0	1.0	NA	NA
Styrene	0.27	1.0	0.95	1.0	NA	NA
Bromoform	0.36	1.0	0.73	1.0	NA	NA
Isopropyl Benzene	0.37	1.0	0.85	1.0	NA	NA
1,1,2,2-Tetrachloroethene	0.48	1.0	0.59	1.0	NA	NA
1,2,3-Trichloropropane	0.78	3.0	1.1	3.0	NA	NA
trans-1,4-Dichloro-2-Butene	0.67	5.0	0.86	5.0	NA	NA
n-Propyl Benzene	0.45	1.0	0.87	1.0	NA	NA
Bromobenzene	0.48	1.0	1.0	1.0	NA	NA
1,3,5-Trimethylbenzene	0.53	1.0	0.89	1.0	NA	NA
2-Chlorotoluene	0.58	1.0	0.94	1.0	NA	NA
4-Chlorotoluene	0.43	1.0	1.0	1.0	NA	NA
t-Butylbenzene	0.42	1.0	1.1	1.0	NA	NA
1,2,4-Trimethylbenzene	0.47	1.0	0.91	1.0	NA	NA
s-Butylbenzene	0.48	1.0	0.87	1.0	NA	NA
4-Isopropyl Toluene	0.43	1.0	0.91	1.0	NA	NA
1,3-Dichlorobenzene	0.48	1.0	1.1	1.0	NA	NA
1,4-Dichlorobenzene	0.34	1.0	1.1	1.0	NA	NA
n-Butylbenzene	0.49	1.0	1.2	2.0	NA	NA
1,2-Dichlorobenzene	0.37	1.0	1.0	1.0	NA	NA
1,2-Dibromo-3-Chloropropane	1.00	5.0	0.77	10	NA	NA
1,2,4-Trichlorobenzene	0.47	5.0	1.1	10	NA	NA
Hexachloro-1,3-Butadiene	0.66	5.0	0.71	10	NA	NA
Naphthalene	0.65	5.0	1.0	10	NA	NA
1,2,3-Trichlorobenzene	0.43	5.0	1.1	10	NA	NA
Units:	µg/L		µg/Kg		µg/Kg	

Method Detection Limit (MDL) studies were performed in accordance with 40 CFR Part 136, Appendix B, using six degrees of freedom (waters) or seven degrees of freedom (soils).

MDLs are statistically derived values, and are a measure of short term precision. True detection at the statistical MDL may not be achievable for all analytes and methods.

Reporting Limit (RL) : The RL is the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the statistical MDL, method efficiency, and analyte response. The RL will, at minimum, equal the statistical MDL (rounded). The RL will exceed the statistical MDL for the more variable analytes or methods.

NA indicates data not available.

Waters revised 07/24/96 (F3), 02/11/97 (F5)
Soils revised 02/13/97 (F5)

3/18/97

H2

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS

ANALYTICAL RESOURCES INCORPORATED

Sample No: [redacted]

Lab Sample ID: [redacted]
LIMS ID: 99-8056
Matrix: Sediment
Data Release Authorized: WW
Reported: 06/23/99

QC Report No: [redacted]
Project: [redacted]
Date Sampled: 06/01/99
Date Received: 06/04/99

Instrument: PINN5
Date Analyzed: 06/08/99

Sample Amount: 4.83 g dry Wt
Percent Moisture: 27.2%

CAS Number	Analyte	ug/kg
79-01-6	Trichloroethene	---
127-18-4	Tetrachloroethene	---
100-41-4	Ethylbenzene	---
1330-20-7	m,p-Xylene	---
95-47-6	o-Xylene	---
95-50-1	1,2-Dichlorobenzene	---
541-73-1	1,3-Dichlorobenzene	---
106-46-7	1,4-Dichlorobenzene	---
120-82-1	1,2,4-Trichlorobenzene	---

Spiked compounds for LCS & MS/MSD Recovery limits of 70% to 130%

Volatile Surrogate Recovery	
d4-1,2-Dichloroethane	104%
d8-Toluene	99.6%
Bromofluorobenzene	101%
d4-1,2-Dichlorobenzene	100%

ANALYTICAL RESOURCES INCORPORATED

SOIL VOLATILE SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Sediment [redacted]

Lab ID	Client ID	DCE	TOL	BFB	DCB	TOT OUT
AJ36A	DW 1001-1007	112%	98%	99%	100%	0
AJ36B	REF 1001-1007	112%	99%	100%	99%	0
060899MB	Method Blank	99%	99%	97%	99%	0
AJ36C	13-S(1-3) 1001-100	111%	102%	101%	98%	0
AJ36C-MS	13-S(1-3) 1001-100	106%	104%	102%	99%	0
AJ36C-MSD	13-S(1-3) 1001-100	104%	100%	101%	100%	0
AJ36LCS	Lab Cntrl Sample	97%	98%	100%	100%	0

Surrogate Recovery QC Limits

		LCS/MB LIMITS	(Samples) QC LIMITS
(DCE)	= 1,2-Dichloroethane-d4	(70-130)	(70-130)
(TOL)	= Toluene-d8	(70-130)	(70-130)
(BFB)	= Bromofluorobenzene	(70-130)	(70-130)
(DCB)	= 1,2-Dichlorobenzene-d4	(70-130)	(70-130)

\# Column to be used to flag recovery values

* Values outside of required QC limits

D System Monitoring Compound diluted out

FORM-II VOA-1

ENVIRONMENTAL
RESOURCE ASSOCIATES

PriorityPollutnT™/CLP Inorganic Soils - Hot Plate Digestions

Catalog No. PPS-46

Lot No. 239

Parameter	Total Concentration[1]	Method 3050 ICP-OES/FLAA		Method 3050 ICP-MS/GFAA	
		Certified Value[2]	Performance Acceptance Limits™ [3]	Certified Value[2]	Performance Acceptance Limits™ [3]
TRACE METALS PriorityPollutnT™ (Catalog No 540)	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
aluminum	55300*	5720	3760 - 7690	6740	4430 - 9050
antimony	97.8	26.6	3.49 - 49.6	13.8	1.81 - 25.8
arsenic	202	163	102 - 225	189	118 - 260
barium	992*	195	128 - 261	255	168 - 342
beryllium	89.4	78.9	56.5 - 101	90.8	65.0 - 117
boron	165	121	81.6 - 161	147	99.2 - 195
cadmium	135	114	84.9 - 142	141	105 - 177
calcium	8450*	1280	903 - 1660	1460	1030 - 1890
chromium	237	175	121 - 229	213	147 - 279
cobalt	85.8	73.7	51.8 - 95.6	95.1	66.8 - 123
copper	109	91.0	64.6 - 117	99.8	70.9 - 129
iron	21700*	9080	4830 - 13300	7560	4020 - 11100
lead	92.3	66.0	44.7 - 87.3	84.4	57.1 - 112
magnesium	2770*	1210	888 - 1530	1400	1030 - 1770
manganese	499*	261	204 - 319	297	232 - 362
mercury	2.00	1.75[4]	0.951 - 2.56	1.75	0.951 - 2.56
molybdenum	135	112	78.9 - 146	134	94.0 - 174
nickel	80.9	68.3	38.1 - 98.6	77.5	43.2 - 112
potassium	3170*	1500	957 - 2040	1770	1130 - 2410
selenium	149	123	91.4 - 155	144	107 - 181
silver	68.0	57.2	40.8 - 73.5	47.2	33.7 - 60.7
sodium	15400*	1360	939 - 1830	1660	1130 - 2190
strontium	328*	112	81.1 - 143	136	98.7 - 173
thallium	129	80.0	45.8 - 114	98.4	56.3 - 140
tin	200	174	124 - 224	105	74.8 - 135
titanium	2070*	234	111 - 358	230	109 - 351
vanadium	144	95.4	65.1 - 126	111	75.7 - 148
zinc	261	190	144 - 236	227	173 - 281

CONTINUED ON BACK

Instructions for Drying: When nonvolatile elements are to be determined, samples should be dried for 2 hours at 110 °C. Volatile elements (i.e., Hg, As, Se) should be determined on samples as received; separate samples should be dried as previously described to obtain a correction factor for moisture. Correction for moisture is to be made to the data for volatile elements before comparing to the certified values. This procedure, which was used for the certification of volatile elements, ensures that these elements are not lost during drying. The approximate weight loss on drying has been found to be 0.8%.

Source and Preparation of Material: The river sediment for this SRM was collected from the Buffalo River in the area of the Ohio Street Bridge, Buffalo, N.Y. The U.S. Army Corps of Engineers, under contract to the NBS, collected and screened approximately 908 kg of river sediment and placed it in six 55 gallon Teflon lined drums. The drums were loaded onto a refrigerated truck and transported to the Technimed Corporation for freeze-drying. The freeze-dried sediment was shipped to an NBS contractor's laboratory where it was screened and passed through a 100 mesh sieve (nominal sieve opening of 150 μm) and retained on a 400 mesh sieve (nominal sieve opening of 38 μm). The sieved sediment was returned to NBS, radiation sterilized, blended, and bottled into 50-g units.

Analysis: The homogeneity of the bottled units was assessed using x-ray fluorescence spectrometry. Duplicate one gram samples from 8 randomly selected bottles were analyzed for the following elements: Al, Si, K, Ca, Ti, Fe, Zn, Sr, P, Mn, Rb, and Zr. No statistically significant differences in the composition of samples within or between bottles were observed relative to the uncertainty of the XRF measurements, which is less than 0.4%. Sample inhomogeneity of about 4% for lead was observed in measurements on 250 mg samples by thermal-ionization isotope dilution mass spectrometry. Sample inhomogeneity for lead is reflected in the uncertainty limits placed on the certified value for lead.

Table 1. Certified Values

Element	Wt. %	Element	Wt. %
Aluminum	6.11 ± 0.16	Phosphorus	0.0998 ± 0.0028
Calcium	2.60 ± 0.03	Potassium	2.00 ± 0.04
Carbon	3.348 ± 0.016	Silicon	29.08 ± 0.13
Iron	4.11 ± 0.10	Sodium	0.547 ± 0.014
Magnesium	1.20 ± 0.02	Titanium	0.457 ± 0.018

Element	μg/g	Element	μg/g
Antimony	3.79 ± 0.15	Lead	161 ± 17
Arsenic	23.4 ± 0.8	Manganese	555 ± 19
Barium	414. ± 12	Mercury	1.44 ± 0.07
Cadmium	3.45 ± 0.22	Nickel	44.1 ± 3.0
Chromium	135 ± 5	Thallium	1.2 ± 0.2
Cobalt	14.0 ± 0.6	Uranium	3.13 ± 0.13
Copper	98.6 ± 5.0	Vanadium	95 ± 4
		Zinc	438 ±12

Certified Values and Uncertainty: The certified values are weighted means of results from two or more analytical techniques. The weights for the weighted means were computed according to the iterative procedure of Paule and Mandel (NBS Journal of Research 87, 1982, pp. 377-385). Each uncertainty is the sum, in quadrature, of the half-width of a 95% expected tolerance interval and an allowance for systematic error among the methods used. The interval, the endpoints of which are the certified value minus and plus the uncertainty, respectively, will cover the concentration in a minimum sample weight of 250 mg of this SRM for at least 95% of the samples with 95% confidence.

Sequim Bay Sediment Data w/o HPLC & Isotopic Data (From 6/96 to 7/96)

Compound	Expected ug/Kg	n	Average	Std Dev
Naphthalene	170	77	73	25.04
2-Methylnapthalene	170	75	89	33.05
1-Methylnapthalene	170	30	146	56.98
Biphenyl	849	25	753	469.07
2,6-Dimethylnapthalene	170	22	238	196.59
Acenaphthylene	170	58	60	22.01
Acenaphthene	170	79	95	23.09
Fluorene	170	80	98	23.65
Phenanthrene	170	81	166	76.99
Anthracene	170	81	111	37.89
1-Methylphenanthrene	170	23	227	313.19
Fluoranthene	170	80	143	79.34
Pyrene	170	81	132	74.29
Benzo(a)anthracene	170	81	116	41.03
Chrysene	170	80	128	52.67
Benzo(b)fluoranthene	170	66	132	124.91
Benzo(e)pyrene	340	24	326	129.33
Benzo(a)pyrene	170	81	120	47.15
Perylene	170	33	169	92.14
Indeno(123-cd)pyrene	170	10	84	60.85
Dibenz(ah)anthracene	170	79	101	32.87
Benzo(ghi)perylene	170	85	91	49.77
Hexachorobenzene	1.7	12	1.0	0.08
Lindane	1.7	25	1.3	0.86
Heptachlor	1.7	4	2.3	1.69
Aldrin	1.7	17	1.7	0.80
Heptachlorepoxide	1.7	21	1.8	1.02
alpha-Chlordane	8.5	16	4.0	1.10
trans-Nonachlor	1.7	12	0.9	0.10
Dieldrin	1.7	21	1.3	0.64
Mirex	3.4	12	1.1	0.29
o,p-DDE	3.4	16	1.3	1.06
p,p-DDE	3.4	17	1.6	1.37
o,p-DDD	3.4	13	1.2	0.82
p,p-DDD	3.4	16	1.5	0.99
o,p-DDT	3.4	16	0.9	0.60
p,p-DDT	3.4	4	2.5	1.78
Aroclor 1254	170	36	112	39.47
Chlorinated terphenyl	85	0		
Phenol	560	55	171	124.66
4-Methylphenol	509	55	181	114.22
Pentachlorophenol	509	54	351	317.10
alpha-BHC	1.7	12	3.1	2.53

Sequim Bay Sediment Data w/o HPLC & Isotopic Data (From 6/86 to 7/96)

Compound	Expected ug/Kg	n	Average	Std Dev
1,2-Dichlorobenzene	170	41	20	7.35
1,3-Dichlorobenzene	102	48	26	9.99
1,4-Dichlorobenzene	51	37	12	7.40
Nitrobenzene	170	2	38	53.03
2,6-Dinitrotoluene	170	0		
2,4-Dinitrotoluene	170	0		
4-Chlorophenylphenyl ether	170	40	102	22.87
4-Bromophenylphenyl ether	170	42	234	56.12
Isophorone	170	44	75	26.42
Hexachlorobutadiene	170	7	6	8.16
alpha-Endosulfan	3.4	6	26.5	3.89
beta-Endosulfan	3.4	8	20.0	4.17
Endrin	3.4	5	8.2	1.02
Tributyl tin chloride	170	21	116	140.17
Coprostanol	272	22	302	123.67
2-Methoxyphenol	509	8	103	119.56
Tetrachloroguiacol	509	13	456	274.71
Diethylhexyl phthalate	170	47	180	217.79
Diphenyl isophthalate	170	0		
Benzoic acid		36	291	227.98
Butylbenzyl phthalate		7	18	17.03
9H-Carbazole		4	24	26.59
Dibenzofuran		6	11	14.52
Benzyl alcohol		3	12	4.90
Nitrobenzene-d5		39	56	16.58
2-Fluorobiphenyl		39	70	16.69
Terphenyl-d14		47	114	120.34
Pyrene-d10		12	94	35.23
Phenol-d5		39	64	15.02
2-Fluorophenol		39	60	14.04
1,2-Dichlorobenzene-d4		19	53	14.17
2,4,6-Tribromophenol		20	73	17.83
Anthracene-d10		2	87	2.26
2,3,5,6-p-Cresol-d4		2	79	19.73
Fluoranthene-d10		2	105	24.32
Dibenz(ah)anthracene-d14		9	246	350.65
Acridine-d9		2	73	70.57
2-Chlorophenol-d4		17	56	14.63
Diphenyl-d10		6	77	29.56
Fluoranthene-d10		6	96	24.33

F-2 Biological Testing

Quality Assurance/ Quality Control (QA/QC) Procedures

Quality Assurance/Quality Control (QA/QC) is an integral component of laboratory operations as a means of ensuring that data being generated are of acceptable quality and scientifically defensible. This is accomplished through overall quality assurance practices (e.g., staff training, standardized methods, documentation) as well as quality control measures applied to individual tests (e.g., negative controls, reference toxicants). The policies, objectives and practices of the EVS laboratory QA/QC program are documented in the EVS QA/QC Manual, which is available in the laboratory. Specific QA/QC requirements are also included in each Standard Operating Procedure (SOP).

The following generic QA/QC procedures apply to all bioassays.

Negative Controls — All bioassays must be conducted using well-established negative (clean) controls. For every test series with a particular organism, one test chamber or series of chambers must contain clean dilution water, or clean sediment plus dilution water for sediment bioassays. In the case of tests involving chemical extraction procedures, solvent controls and/or solvent extracts of clean sediment will comprise additional negative controls. The complete test series must be repeated if the negative control organisms fail to meet the acceptability criteria specified by the test protocol (e.g., ≥90% survival) or show evidence of adverse sublethal effects.

Reference Toxicants — All bioassays must include the use of well-established standard reference toxicants. Reference toxicants are used to provide insight into mortalities or changing sensitivity that may occur as a result of disease, changes in tolerance, loading density, acclimation, or stress tolerance developed during handling or testing procedures. Protocol-specific requirements are provided in the SOPs, but generally reference toxicant tests are conducted at least monthly for organisms cultured in-house, and concurrently with each batch of organisms received from outside sources. Control charts are constructed for each test species-reference toxicant-test type combination to monitor performance.

Test Organisms — Only healthy organisms of similar size and life history stage are to be used in bioassays. Size is particularly important when conducting growth studies. A further separation of sex may be done but is of questionable validity for comparison with field populations. Taxonomic identifications of bioassay organisms must be confirmed by a qualified taxonomist.

Reference Samples (Sediments) — Control sediments are generally those from which test animals were collected. As such, physical and chemical sediment characteristics (for example, grain size and organic content) may be very different from those of the test sediments. Where this is the case, one or more reference sediments should be added to the test series. Reference sediments should be collected from an area documented to be free from chemical contamination and should represent the range of important physical and chemical variables found in the test sediments. Data derived from such a sample, if in fact it is totally free of contamination, can be used to separate toxicant effects from unrelated effects such as those of sediment grain size.

Randomization and Blind Testing — All treatment and bioassay containers should be randomized, and testing should be conducted without laboratory personnel knowing the identities of the samples. Replicates of each treatment should be assigned a sample code during testing and randomized in the test sequence.

Instrument Calibration — Calibration of instruments is required to ensure that accurate measurements are made throughout a test and to ensure the equipment is operating correctly. Each water quality instrument (dissolved oxygen, pH, conductivity meters and refractometers) or balance must be calibrated at the start of each day (and any time the environmental conditions are changed). Each piece of equipment has a logbook for daily recording of calibration information, repairs, replacement, etc. Each instrument is calibrated according to the manufacturer's instructions.

Maintenance/Measurement of Water Quality — Bioassays involving exposure of organisms in aqueous media require that the media be uncontaminated and that proper water quality conditions be maintained to ensure the survival of the organisms, and to ensure that undue stress is not exerted on the organisms unrelated to the test material. At a minimum, the following variables must be measured at the beginning and termination of testing: dissolved oxygen, pH, conductivity/salinity (whichever is appropriate) and temperature. Depending on the test method, measurements of water hardness, alkalinity, ammonia (interstitial or overlying water) and/or sulphide may also be required. Any adjustments made (e.g.,pH adjustment, increased aeration) must be recorded, explaining how and why they were done.

Standard Laboratory Procedures — Standard laboratory procedures must be followed in all testing. These include proper documentation (e.g., chain-of-custody, test solution preparation), proper cleaning, avoidance of contamination and maintenance of appropriate test conditions. All unusual observations and deviations from established procedures must be promptly reported to the QA/QC Coordinator and Laboratory Manager at the time of their occurrence and documented for reporting to the client.

APPENDIX G

Data QA Worksheets

[PSDDA Tracking Number]

TABLE 5. DREDGER'S CHECKLIST

Project Name _____ Applicant _____

Location _____ Date _____

Area Rank(s) _____

Partial characterization (PC) or full characterization (FC)? _____

Total volume of sediment to be dredged (attach diagram) _____

SAMPLES COLLECTED

	Chemistry	Bioassays	Bioaccumulation
# Stations			
# Field samples[a]			
# Study samples[b]			
Shipboard storage conditions			

ANALYTICAL STRATEGY

Chemistry only _____ Synoptic chemistry and biology _____

Biology only _____ Chemistry 1st, biology 2nd _____

TARGET VARIABLES

	Chemistry	Bioaccumulation
All PSSDA chemicals of concern		
Additional chemicals		
Deleted chemicals		

FIELD COLLECTION

What positioning method was used? (describe) _____

Station positioning information attached? _____

Sampling strategy (attach diagram) _____

Sampling device _____

Were chemistry/bioassay samples homogenized prior to subsampling? _____

Were corresponding chemistry and bioassay subsamples taken from the same composite? _____

[a] Field samples includes all samples collected from discrete coordinates in a dredging volume.
[b] Study samples includes all samples remaining after compositing has been conducted.

[PSDDA Tracking Number]

TABLE 6. CHECKLIST FOR CONVENTIONAL VARIABLES IN SEDIMENT

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date: Sampled _____

Received by lab _____

Analysis began _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

COMPLETENESS AND HOLDING CONDITIONS

	TOC	TVS	Total Sulfides	Ammonia	Total Solids	Grain Size Distribution
Method (identify)						
# Samples submitted						
# Samples analyzed						

Holding conditions acceptable? (Y/N) _____

(see final page of checklist for guidelines)

If no, identify samples _____

FORMAT

Standard data report sheet

Concentrations in proper units and significant figures _____

Sample detection limits provided, when applicable (total sulfides, ammonia) _____

Qualifiers defined (e.g., U = undetected)

_____

_____

_____

_____

TABLE 6. (Continued)

QA/QC SAMPLES

Method Blank

TOC Total # _____

Frequency _____
(minimum 1 per 20 samples)[a]

Amount detected in blank _____
(no PSEP control limit)

Certified Reference Materials

TOC *Total #* _____

Frequency _____
(minimum 1 per survey)

CRM used _____

Within 95% confidence interval? _____
(not a PSEP control limit)

Analytical Replicates

	TOC	TVS	Total Sulfides	Ammonia	Total Solids	Grain Size Distribution
Total #	_____	_____	_____	_____	_____	_____
Frequency (minimum 1 triplicate per 20 samples)[a]	_____	_____	_____	_____	_____	_____

[a] Recommended by PSEP (1986).

TABLE 6. (Continued)

RECOMMENDED SAMPLE SIZES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SEDIMENT CONVENTIONAL VARIABLES (PSEP 1986)

Variable	Minimum Sample Size (grams)[a]	Container[b]	Preservation	Maximum Holding Time
Particle size	100-150[c]	P,G	Cool, 4° C	6 months[d]
Total solids	50	P,G	Freeze	6 months[d]
Total volatile solids	50	P,G	Freeze	6 months[d]
Total organic carbon	25	P,G	Freeze	6 months[d]
Total sulfides	50	P,G	Cool, 4° C, 1N zinc acetate	7 days[d]
Ammonia	20	P,G	Cool, 4° C (minimize air contact, keep field moist)	7 days[e]

[a] Recommended field sample sizes for one laboratory analysis. If additional laboratory analyses are required (e.g., replicates), the field sample size should be adjusted accordingly.

[b] P = polyethylene; G = glass.

[c] Sandy sediments require larger sample sizes than do muddy sediments.

[d] This is a suggested holding time. No EPA criteria exist for the preservation of this variable.

[e] This holding time is recommended by Plumb (1981).

TABLE 7. CHECKLIST FOR METALS IN SEDIMENT

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted[a]? (Y/N)_____

Digestion procedure [Total Acid Digest (TAD) or Strong Acid Digest (SAD)] _____

COMPLETENESS AND HOLDING CONDITIONS

Samples submitted _____ # Samples analyzed _____

Holding conditions acceptable? (Y/N) [6 months frozen for metals except mercury; 28 days frozen (in glass) for mercury] _____

If no, identify samples _____

FORMAT

Standard data report sheet

Concentrations in proper units and significant figures _____

Qualifiers defined (e.g., U = undetected)

_____

_____

_____

Sample detection limits (DL) provided for each analyte? (Y/N) _____

_____

TABLE 7. (Continued)

QA/QC SAMPLES

Preparation Blank

Total # _____

Frequency[b] _____
(minimum 5% or 1 per batch, whichever is more frequent)[c]

Chemicals observed above detection limits in one or more blanks[c]

_____ _____

_____ _____

Certified Reference Materials

Total # _____

Frequency[b] _____
(minimum 5% or 1 per batch, whichever is more frequent)[c]

CRM used _____

Chemicals outside 80-120% recovery[c]

_____ _____

_____ _____

(for chemicals without certified values, use matrix spike results)

Analytical Replicates

Total # _____

Frequency[b] _____
(minimum 5% or 1 per batch, whichever is more frequent)[c]

Samples/chemicals with >20% relative percent difference (RPD) or coefficient of variation (CV)[c]

_____ _____

_____ _____

Matrix Spikes

Total # _____

Frequency[b] _____
(minimum 5% or 1 per batch, whichever is more frequent)[c]

Chemicals with recovery outside 75-125%[c]

_____ _____

_____ _____

TABLE 7. (Continued)

NOTE: The following information will be filled out by PSDDA personnel rather than the laboratory.

Detection Limits

Did any DL exceed SL? (Y/N) _____

If yes, detection limits exceeding SL (identify samples)

Antimony _____	Arsenic _____	Cadmium _____
Copper _____	Lead _____	Mercury _____
Nickel _____	Silver _____	Zinc _____

(see Table 2)

Preparation Blanks (Relative blank contamination)

Are sample results <5 times blank values in any samples? (Y/N) _____

If yes, identify elements and samples

_____ _____

_____ _____

[a] See Appendix A for list.

[b] For batches of 5 samples or less, the minimum QA checks should be a blank and the analysis of a CRM (and matrix spikes for any analytes not certified in the CRM). In general, the priority of QA checks for batches of ≤5 samples should be as follows: CRM > analytical replicate > matrix spikes.

[c] PSEP control limit.

[PSDDA Tracking Number]

TABLE 8. CHECKLIST FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SEDIMENT

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted[a]? (Y/N) _____

Analytical method _____

COMPLETENESS AND HOLDING CONDITIONS

	# Samples Submitted	# Samples Analyzed
A/B/N	_____	_____
Pesticides/PCB	_____	_____

Holding conditions acceptable? (Y/N) (1 year for frozen sediment)

_____

If no, identify samples _____

Extract holding times acceptable? (Y/N) _____

If no, identify samples _____

FORMAT

Standard data report sheet

Concentrations in proper units and significant figures _____

Qualifiers defined (e.g., U = undetected)

_____

_____

_____

_____

[PSDDA Tracking Number]

TABLE 8. (Continued)

Sample detection limits (DL) provided for each analyte? (Y/N) _____

QA/QC SAMPLES

Method Blank

Total # _____

Frequency _____
(minimum 1 per extraction batch)[b]

Chemicals detected above 5 μg total (for phthalates) and 2.5 μg total[b]
(for other organic compounds; lower levels may be appropriate for pesticides and PCBs)

_____ _____

_____ _____

Certified Reference Materials

Total # _____

Frequency _____
(<50 samples - 1 per set of samples submitted to lab; >50 samples - 1 per 50 samples analyzed)[b]

CRM used _____

Chemicals outside 95% confidence interval (for certified values)[b]

_____ _____

_____ _____

Analytical Replicates

Total # _____

Frequency _____
(<20 samples - 1 per set of samples submitted to lab; ≥20 samples - 1 triplicate and additional duplicate for minimum of 5% total replication)[b]

Samples/chemicals with >100% RPD or CV[b]

_____ _____

_____ _____

Matrix Spikes (not required for A/B/N if isotope dilution used)

Total # _____

Frequency[c] _____
(<20 samples - 1 per set of samples submitted to lab; ≥20 samples - 5% of total samples)[b]

Chemicals with <50% recovery[b]

_____ _____

_____ _____

TABLE 8. (Continued)

NOTE: The following information will be filled out by PSDDA personnel rather than the laboratory.

Detection Limits

Did any DL exceed SL? (Y/N) _____

If yes, detection limits exceeding SL (identify samples)

A/B/N (PAH) _____ A/B/N (phenols, benzoic acid, benzyl alcohol) _____ A/B/N (other) _____

PCB _____ Pesticides _____

(see Table 2)

Surrogate Recovery (A/B/N)

Were surrogates added to all samples?[b] (Y/N) _____

Was the isotope dilution technique used? (Y/N) _____

If yes, identify compounds with <10 percent recovery (also identify samples)

_____ _____

_____ _____

If no, identify compounds with <50 percent recovery[b] (also identify samples)

_____ _____

_____ _____

Surrogate Recovery (Pesticides/PCBs)

Were surrogates added to all samples?[b] (Y/N) _____

Identify samples with <50 percent surrogate recovery[b]

_____ _____

_____ _____

Method Blanks (Relative blank contamination)

For target compounds other than phthalates, was blank contamination >5 percent of any sample concentrations?[b] (Y/N) _____

If yes, identify compounds and samples

_____ _____

_____ _____

TABLE 8. (Continued)

For phthalates, was blank contamination >50 percent of any sample concentration?[b]

(Y/N) _____

If yes, identify compounds and samples

_____ _____

_____ _____

[a] See Appendix A for list.

[b] For batches of 5 samples or less, the minimum QA checks should be a blank and the analysis of a CRM (and matrix spikes for any analytes not certified in the CRM). In general, the priority of QA checks for batches of ≤ 5 samples should be as follows: CRM > analytical replicate > matrix spikes.

[c] PSEP control limit.

[PSDDA Tracking Number]

TABLE 13. CHECKLIST FOR AMPHIPOD MORTALITY BIOASSAY

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____ Batch ____ of ____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted[a]? (Y/N)_____

COMPLETENESS AND HOLDING CONDITIONS

Samples submitted _____ # Samples analyzed _____

Holding conditions acceptable? (Y/N) (4° C in nitrogen atmosphere ≤6 weeks)[b] _____

If no, identify samples_____

Interstitial salinities acceptable (i.e., ≥25 ‰)[c]? (Y/N)_____

If no, identify samples _____

FORMAT

Standard data report sheet

Number of survivors and percent mortality reported for each replicate (including field samples, positive controls, and negative controls)? (Y/N)_____

Water quality variables reported for each replicate? (Y/N)_____

QA/QC SAMPLES

Positive Control (not required by PSDDA)

Reference toxicant _____

Exposure concentrations _____

Organism response (LC50) _____

Dose response? (Y/N) _____

TABLE 13. (Continued)

QA/QC SAMPLES (*continued*)

Negative Control

Collection site _____

Total number _____

Mean mortality >10%?[c] _____

Analytical Replicates

Number per sample _____

Any <5 RPD?[c] _____

Mortality s.d. ≥15? [d] _____

Water Quality

Samples with temperature <14 or >16° C[c] _____

Samples with salinity <27 or >29 ‰[c] _____

Samples with pH <7 or >9[e] _____

Samples with DO ≤5 mg/L[e] _____

Reference

Collection site _____

Total number analyses _____

Mean mortality _____

[a] See Appendix A for list.

[b] PSDDA control limit.

[c] PSEP control limit.

[d] PSEP guideline.

[e] General guideline.

[PSDDA Tracking Number]

TABLE 14. CHECKLIST FOR JUVENILE INFAUNA MORTALITY BIOASSAY

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____ Batch ____ of ____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Test species _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted?[a] (Y/N)_____

COMPLETENESS AND HOLDING CONDITIONS

Samples submitted _____ # Samples analyzed _____

Holding conditions acceptable? (Y/N) (4° C in nitrogen atmosphere ≤6 weeks)[b] _____

If no, identify samples_____

FORMAT

Standard data report sheet

Number of survivors and percent mortality reported for each replicate (including field samples, positive controls, and negative controls)? (Y/N)_____

Water quality variables reported for each replicate? (Y/N)_____

QA/QC SAMPLES[c]

Positive Control (not required by PSDDA)

Reference toxicant _____

Exposure concentrations _____

Organism response (LC_{50}) _____

TABLE 14. (Continued)

QA/QC SAMPLES (continued)

Negative Control

Collection site _____

Total number _____

Mean mortality >10%?[d] _____

Analytical Replicates

Number per sample _____

Any <5 RPD?[d] _____

Reference

Collection site _____

Total number analyses _____

Mean mortality _____

[a] See Appendix A for list.

[b] PSDDA control limit.

[c] Water quality conditions are not yet specified for this test.

[d] General guideline.

[PSDDA Tracking Number]

TABLE 15. CHECKLIST FOR SEDIMENT LARVAL BIOASSAY (SOLID PHASE)

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____ Batch ____ of ____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Test species _____ Exposure period _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted?[a] (Y/N) _____

COMPLETENESS AND HOLDING CONDITIONS

Samples submitted _____ # Samples analyzed _____

Holding conditions acceptable? (Y/N) (4° C in nitrogen atmosphere ≤6 weeks)[b] _____

If no, identify samples _____

FORMAT

Standard data report sheet

Number of larvae evaluated, percent mortality, and percent abnormality reported for each replicate (including field samples, positive controls, and negative controls)? (Y/N) _____

Water quality variables reported for each replicate? (Y/N) _____

QA/QC SAMPLES

Positive Control (not required by PSDDA)

Reference toxicant _____

Exposure concentrations _____

Organism response (EC_{50}) _____

TABLE 15. (Continued)

Negative Control (Seawater)[c]

Collection site _____

Total number _____

Mean abnormality >10%[d]? _____

Negative Control (Sediment)[c]

Collection site _____

Total number _____

Mean abnormality >10%[d]? _____

Analytical Replicates

Number per sample _____

Any <5 RPD?[d] _____

Water Quality

Crassostrea gigas

Samples with temperature <19 or >21° C[c] _____

Samples with salinity <27 or >29 ‰[c] _____

Samples with pH <7 or >9[e] _____

Samples with DO ≤4 mg/L[b] _____

Mytilus edulis

Samples with temperature <12 or >14° C[e] _____

Samples with salinity <27 or >29 ‰[d] _____

Samples with pH <7 or >9[e] _____

Samples with DO ≤4 mg/L[b] _____

Dendraster excentricus

Samples with temperature <11 or >13° C[e] _____

Samples with salinity <28 or >32‰[e] _____

Samples with pH <7 or >9[e] _____

Samples with DO ≤4 mg/L[b] _____

TABLE 15. (Continued)

Strongylocentrotus purpuratus	
Samples with temperature <11 or >13° C[e]	
Samples with salinity <28 or >32‰[e]	
Samples with pH <7 or >9[e]	
Samples with DO ≤4 mg/L[b]	
Reference	
Collection site	
Total number analyses	
Mean mortality	
Mean abnormality	

[a] See Appendix A for list.

[b] PSDDA control limit.

[c] A control limit for mortality is presently not defined by PSDDA.

[d] PSEP control limit.

[e] General guideline.

[PSDDA Tracking Number]

TABLE 16. CHECKLIST FOR SEDIMENT LARVAL BIOASSAY (SUSPENDED PHASE)

Project Name _____ Laboratory Report _____

Lab _____ Lab # _____ Batch ____ of ____

Responsible Technician _____

Reviewed by _____ Date checklist prepared _____

Date Sampled _____

Received by lab _____

Analysis began _____

Test species _____ Exposure period _____

Problems noted (e.g., deviations from prescribed methods, analytical problems)

_____

_____

All required documents submitted?[a] (Y/N)_____

COMPLETENESS AND HOLDING CONDITIONS

Samples submitted _____ # Samples analyzed _____

Holding conditions acceptable? (Y/N) (4° C *in nitrogen atmosphere ≤6 weeks*)[b] _____

If no, identify samples_____

FORMAT

Standard data report sheet

Number of larvae evaluated, percent mortality, and percent abnormality reported for each replicate (including field samples, positive controls, and negative controls)? (Y/N)_____

Water quality variables reported for each replicate? (Y/N)_____

QA/QC SAMPLES

Positive Control (not required by PSDDA)

Reference toxicant _____

Exposure concentrations _____

Organism response _____

TABLE 16. (Continued)

Negative Control (seawater)

Collection site _____

Total number _____

Mean abnormality >10%[d]? _____

Negative Control (Sediment)[c]

Collection site _____

Total number _____

Mean abnormality >10%[d]? _____

Analytical Replicates

Number per sample _____

Any <5 RPD?[d] _____

Water Quality

Crassostrea gigas

Samples with temperature <19 or >21° C[c] _____

Samples with salinity <27 or >29 ‰[c] _____

Samples with pH <7 or >9[c] _____

Samples with DO ≤4 mg/L[b] _____

Mytilus edulis

Samples with temperature <12 or >14° C[c] _____

Samples with salinity <27 or >29 ‰[d] _____

Samples with pH <7 or >9[c] _____

Samples with DO ≤4 mg/L[b] _____

Dendraster excentricus

Samples with temperature <11 or >13° C[c] _____

Samples with salinity <28 or >32 ‰[c] _____

Samples with pH <7 or >9[c] _____

Samples with DO ≤4 mg/L[b] _____

TABLE 16. (Continued)

Strongylocentrotus purpuratus	
Samples with temperature <11 or >13° C[c]	
Samples with salinity <28 or >32 ‰[c]	
Samples with pH <7 or >9[c]	
Samples with DO ≤4 mg/L[b]	
Reference	
Collection site	
Total number analyses	
Mean mortality	
Mean abnormality	

[a] See Appendix A for list.

[b] PSDDA control limit.

[c] A control limit for mortality is presently not defined by PSDDA.

[d] PSEP control limit.

[e] General guideline.

TABLE 18. QA1 SUMMARY MATRIX - CHEMICAL VARIABLES

Matrix _____

QA1 Characteristic	Conventional Variables	Metals	Semivolatile Organic Chemicals	Volatile Organic Chemicals
% Complete Field				
Laboratory				
Units and Significant Figure				
Detection Limits				
Holding Conditions and Times				
Method Blank				
Standard Reference Material				
Replicates				
Matrix Spikes				

TABLE 19. QA1 SUMMARY MATRIX - BIOASSAYS

Matrix _____

QA1 Characteristic	Amphipod Mortality	Juvenile Infauna Mortality	Sediment Larval Test	Microtox
% Complete Field				
Laboratory				
Format				
Holding Conditions				
Positive Control				
Negative Control				
Replicates				
Experimental Conditions (Water Quality)				

[PSDDA Tracking Number]

TABLE 20. PSDDA DATA REVIEW SUMMARY: SEDIMENT CHEMISTRY

Data reviewer _____ Date reviewed _____

Sampling plan followed? _____

Data set complete? _____

Format acceptable? _____

Blanks acceptable? _____

Accuracy acceptable? _____

Precision acceptable? _____

Final Conclusions _____

[PSDDA Tracking Number]

TABLE 21. PSDDA DATA REVIEW SUMMARY: BIOASSAYS

Data reviewer _____ Date reviewed _____

Project name _____ PSDDA tracking # _____

Sampling plan followed? _____

Data set complete? _____

Format acceptable? _____

Precision acceptable? _____

Controls acceptable? _____

Testing conditions appropriate? _____

Final Conclusions _____

APPENDIX H

Data Requirements for the Dredged Analysis Information System

Table H-1. DAIS Raw Data Requirements

Sample Locations and Compositing	Test Sediment	Reference Sediment	Control Sediment	Seawater Control
Latitude and Longitude (to nearest 0.1 second)				
NAD 1927 or 1983				
USGS Benchmark ID				
Station name (e.g. Carr Inlet)				
Water depth (corrected to MLLW)				
Drawing showing sampling locations and ID numbers				
Compositing scheme (sampling locations/depths for composites)				
Sampling method				
Sampling dates				
Estimated volume of dredged material represented by each DMMU				
Positioning method				
Sediment Conventionals				
Preparation and analysis methods				
Sediment conventional data and QA/QC qualifiers				
QA qualifier code definitions				
Triplicate data for each sediment conventional for each batch				
Units (dry weight except total solids)				
Method blank data (sulfides, ammonia, TOC)				
Method blank units (dry weight)				
Analysis dates (sediment conventionals, blanks, TOC CRM)				
TOC CRM ID				
TOC CRM analysis data				
TOC CRM target values				
Grain Size Analysis				
Fine grain analysis method				
Analysis dates				
Triplicate for each batch				
Grain size data (complete sieve and phi size distribution)				

Chemicals of Concern Analysis Data				
	Metals	Semivol.	Pest./ PCBs	Volatiles
Extraction/digestion method				
Extraction/digestion dates (test sediment, blanks, matrix spike, reference material)				
Analysis method				
data and QA qualifier included for:				
test sediments				
reference materials including 95% confidence interval (each batch)				
method blanks (each batch)				
matrix spikes (each batch)				
matrix spike added (dry weight basis)				
replicates (each batch)				
Units (dry weight)				
Method blank units (dry weight)				
QA/QC qualifier definitions				
Surrogate recovery for test sediment, blank, matrix spike, ref. material				
Analysis dates (test sediment, blanks, matrix spike, reference material)				

Shaded areas indicate required data

BIOASSAYS

Amphipod Mortality and Emergence				
	Each Batch	Test Sediment	Reference Sediment	Control Sediment
Species Name				
Mortality and Emergence:				
Start date				
Daily emergence (for 10 days)				
Survival at end of test				
Number failing to rebury at end of test				
Positive Control:				
Toxicant used				
Toxicant concentrations				
Exposure time				
LC50				
LC50 method of calculation				
Start date				
Survival data				
Water Quality Measurement Methods:				
Dissolved oxygen				
Ammonia				
Interstitial salinity				
Sulfide				
Water salinity				
Water Quality:				
Temperature (day 0 through day 10)				
pH (day 0 through day 10)				
Dissolved oxygen (day 0 through day 10)				
Water salinity (day 0 through day 10)				
Sulfide (day 0, day 10)				
Ammonia (day 0, day 10)				
Interstitial water salinity (day 0)				

Neanthes 20-day Growth Test				
	Each Batch	Test Sediment	Reference Sediment	Control Sediment
Starting age (in days post-emergence)				
Food type				
Quantity (mg/beaker/interval)				
Feeding interval (hours)				
Biomass and Mortality:				
Start date				
Initial counts and weights (mg dry weight)				
Number of survivors and final weights (mg dry weight)				
Positive Control:				
Toxicant used				
Toxicant concentration				
Exposure time				
LC50				
LC50 method of calculation				
Start date				
Survival data				
Water Quality Measurement Methods				
Dissolved oxygen				
Ammonia				
Interstitial salinity				
Sulfide				
Water salinity				
Water Quality:				
Temperature (days 0, 3, 6, 9, 12, 15, 18, 20)				
pH (days 0, 3, 6, 9, 12, 15, 18, 20)				
Dissolved oxygen (days 0, 3, 6, 9, 12, 15, 18, 20)				
Water salinity (days 0, 3, 6, 9, 12, 15, 18, 20)				
Interstitial salinity (day 0)				
Sulfide (initial and final)				
Ammonia (initial and final)				

Sediment Larval Mortality and Abnormality				
	Each Batch	Test Sediment	Reference Sediment	Seawater Control
Species Name				
Bioassay Parameters				
Inoculation time (hours)				
Exposure time (hours)				
Stocking beaker density (#/ml)				
Stocking aliquot size (ml)				
Aeration (yes/no)				
Mortality and Abnormality:				
Start date				
Initial count (minimum of five 10-ml aliquots)				
Final Count:				
Aliquot size (ml)				
Number normal per aliquot				
Number abnormal per aliquot				
Water Quality Measurement Methods:				
Dissolved oxygen				
Ammonia				
Sulfide				
Water salinity				
Water Quality:				
Temperature (daily)				
pH (daily)				
Dissolved oxygen (daily)				
Water salinity (daily)				
Sulfide (initial and final)				
Ammonia (initial and final)				
Positive Control:				
Toxicant used				
Toxicant concentrations				
Exposure time				
EC50				
EC50 method of calculation				
Start date				
Normal/abnormal counts				

Historic Property Inventory Report for Sherwood Press **at** 811 Southwest 5th Olympia, Thurston, 98501 **SCAN NUMBER:** 853

LOCATION SECTION

Field Site No.: 34-382 **OAHP No.:** **Date First Recorded:** 07/01/1997

Historic Name: Sherwood Press **Common Name:**

Property Address: 811 Southwest 5th Olympia, Thurston, 98501 **Comments:** OLYMPIA

County	Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	Quadrangle
Thurston	T18R02W	15	SE		TUMWATER

UTM Reference
UTM Zone: 10 **Spatial Type:** Point **Acquisition Code:** Unkown
Sequence: 0 **Easting:** 506740 **Northing:** 5209740

Tax No./Parcel No.: 68600400100
Plat/Block/Lot: Percival L1 Part 2 Blk 4
Supplemental Map(s): City of Olympia Planning Department
Acreage < one

IDENTIFICATION SECTION

Field Recorder: Shanna Stevenson **Date Recorded:** 07/01/1997

Owner's Name: Jocelyn Dohm
Owner Address: 505 Flora Vista Road NE
City/State/Zip: Olympia, WA 98506

Classification: Building
Within a District? No
Contributing?

Resource Status
Survey/Inventory
Local Register

Comments

National Register Nomination:

Local District:

National Register District/Thematic Nomination Name:

DESCRIPTION SECTION

Historic Use: Commerce/Trade - Business
Current Use: Commerce/Trade - Business
Plan: Rectangle **No. of Stories:** 1
Structural System: Balloon Frame/ Platform Frame

View of 2-Northeast Facade **taken** 07/01/1997
Photography Neg. No (Roll No./Frame No.): 43-20
Comments:

Changes to plan: Intact
Changes to interior: Intact
Changes to original cladding: Intact
Changes to other:
Changes to windows: Intact
Other (specify):

Style
Commercial
Tudor

Form

Cladding	Foundation	Roof Material	Roof Type
Shingle	Concrete - Poured	Wood - Shingle	Gable

NARRATIVE SECTION **Date Of Construction:** 1940

Architect: Phyllis Dohm **Engineer:** **Builder:**

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Study Unit	Other
Architecture/Landscape Architecture	
Commerce	

Statement of Significance

The shop was built in 1940 by Jocelyn and her father Edward Dohm, a former Olympia City Commissioner in a design by her sister Phyllis Dohm Mueller. The shop is adjacent to the family home. The shop is a distinctively designed English Revival Style building built entirely of cedar with a board and batten interior and cedar exterior shingles for siding and roofing. Jocelyn Dohm actually helped build the shop and roofed the structure herself. The building remains as the original set among the trees in west Olympia except for a small rear addition added over 30 years ago which is indistinguishable from the original structure. The shop is heated by fireplace. Miss Dohm was a recent graduate of the University of Washington when she began her business with a 1850's style press. She has provided personalized printing services with hand set type and a hand press for over 50 years. Sherwood Press provides distinctive printing services. The archives of the Sherwood Press document the social history of the area over the past 52 years. Miss Dohm has hosted many school children who are allowed to run the press. The shop is a small treasure of history complete with hand-type, vintage presses and an atmosphere of a craft well-practiced.

Description of Physical Appearance

Small, one-story, steeply gabled building with cross gables on the west side of Olympia set above Capitol Lake. Shingle cladding. Offset gable on north side. Various sizes of multi-pane windows including a large multi-pane window on south side. Entry on east side is sheltered by a steep gable with bracketed supports. Small rear addition. Brick chimney. The interior has three presses, one dating from the 1850's as well as type and logos.

Major Bibliographic References

Information from Jocelyn Dolm.

Historic Property Inventory Report for Sherwood Press **at** 811 5th Southwest Olympia, Thurston, 98501 **SCAN NUMBER:** 509

LOCATION SECTION

Field Site No.: 34-WH37 **OAHP No.:** **Date First Recorded:** 07/01/1997

Historic Name: Sherwood Press **Common Name:**

Property Address: 811 5th Southwest Olympia, Thurston, 98501 **Comments:** OLYWOMEN

County	Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	Quadrangle
Thurston	T18R02W	15	SE		TUMWATER

UTM Reference
UTM Zone: 10 **Spatial Type:** Point **Acquisition Code:** Unkown
Sequence: 0 **Easting:** 506740 **Northing:** 5209740

Tax No./Parcel No.: 68600400100

Plat/Block/Lot: Percival L1 Part 2 Blk 4

Supplemental Map(s): City of Olympia Planning Department

Acreage < one

IDENTIFICATION SECTION

Field Recorder: Shanna Stevenson **Date Recorded:** 07/01/1997

Owner's Name:	Owner Address:	City/State/Zip:
Jocelyn Dohm	505 Flora Vista Road NE	Olympia, WA 98506

Classification: Building

Within a District? Yes

Contributing? No

Resource Status
Survey/Inventory
Local Register

Comments

National Register Nomination:

Local District: Women's History of Olympia

National Register District/Thematic Nomination Name:

DESCRIPTION SECTION

Historic Use: Commerce/Trade - Business

Current Use: Commerce/Trade - Business

Plan: Rectangle **No. of Stories:** 1

Structural System: Balloon Frame/ Platform Frame

View of 2-Northeast Facade **taken** 07/01/1997

Photography Neg. No (Roll No./Frame No.): 43-20

Comments:

Changes to plan: Intact **Changes to interior:** Intact

Changes to original cladding: Intact **Changes to other:**

Changes to windows: Intact **Other (specify):**

Style
Commercial
Tudor

Form

Cladding	Foundation	Roof Material	Roof Type
Shingle	Concrete - Poured	Wood - Shingle	Gable

NARRATIVE SECTION

Date Of Construction: 1940

Architect: Phyllis Dohm **Engineer:** **Builder:**

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Study Unit	Other
Architecture/Landscape Architecture	
Commerce	
Other	

Statement of Significance

The shop was built in 1940 by Jocelyn and her father Edward Dohm, a former Olympia City Commissioner in a design by her sister Phyllis Dohm Mueller. The shop is adjacent to the family home. The shop is a distinctively designed English Revival Style building built entirely of cedar with a board and batten interior and cedar exterior shingles for siding and roofing. Jocelyn Dohm actually helped build the shop and roofed the structure herself. The building remains as the original set among the trees in west Olympia except for a small rear addition added over 30 years ago which is indistinguishable from the original structure. The shop is heated by fireplace. Miss Dohm was a recent graduate of the University of Washington when she began her business with a 1850's style press. She has provided personalized printing services with hand set type and a hand press for over 50 years. Sherwood Press provides distinctive printing services. The archives of the Sherwood Press document the social history of the area over the past 52 years. Miss Dohm has hosted many school children who are allowed to run the press. The shop is a small treasure of history complete with hand-type, vintage presses and an atmosphere of a craft well-practiced.

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