Budd Inlet Sediment Investigation
Olympia, WA

Summary of Existing Information and Identification of Data Gaps for Sediments

FINAL

Prepared for

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List of Acronyms

BNA	base/neutral/acid
CAD	computer-aided design
COC	constituent of concern
CSL	Contaminant Screening Level
DAIS	Dredged Analysis Information System
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DNAPL	dense non-aqueous phase liquid
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EPA/EMAP	Environmental Protection Agency/Environmental Monitoring and Assessment Program
FS	feasibility study
HPAH	high molecular polynuclear aromatic hydrocarbon
LNAPL	light non-aqueous phase liquid
LOTT	Lacey, Olympia, Tumwater, and Thurston County
LPAH	low molecular polynuclear aromatic hydrocarbon
MBL	multiple benefits line
MTCA	Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
NTR	National Toxics Rule
OHN	Olympia Harbor Navigation
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
pg	picogram
PSAMP	Puget Sound Ambient Monitoring Program
PSDDA	Puget Sound Dredged Disposal Analysis
RA	risk assessment
RI	remedial investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SL	screening level
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SSI	supplemental site investigation
TBT	tributylin
TEF	toxic equivalent factor
TEQ	toxic equivalent quotient
TOC	total organic carbon
TTL	target tissue level
USACE	U.S. Army Corps of Engineers
VOA	volatile organic aromatic

1.0 Introduction

A recent sediment characterization study of the Olympia Harbor Navigation Channel and Port of Olympia berthing area has found elevated concentrations of dioxins/furans in sediments from proposed dredging areas (DMMP 2006). The proposed dredging project has been in the planning process for several years and is intended to restore the navigation channel and berthing areas to permitted depths. The elevated concentrations of dioxins and furans in sediments from Budd Inlet, Olympia, WA, pose an increased risk to human health and the environment. Therefore, the Washington State Department of Ecology (Ecology) is proposing additional studies to better understand the distribution of dioxins/furans in sediments throughout Budd Inlet. The objectives of the Budd Inlet Sediment Investigation study are to:

1) Determine the overall nature and extent of dioxin/furan sediment contamination in Budd Inlet,

2) Evaluate the potential sources of dioxins/furans in sediments, including potential source identification,

3) Better delineate the nature and extent of dioxins/furans (vertically and spatially) in sediments from proposed dredging areas in the navigation channel and berthing area, and

4) Identify priority areas for remediation based on potential for disturbance due to navigation access to the Port of Olympia facilities, and areas that may pose a risk based on dioxin/furan sediment contamination.

This report summarizes the available existing information on relevant environmental investigations and cleanups on properties associated with Budd Inlet and provides a summary of data gaps (i.e., identifies areas in Budd Inlet where additional information on dioxins/furans or other chemicals of concern may be needed). The results and recommendations from this report will guide the development of the Sampling and Analysis Plan (SAP) for the Budd Inlet Sediment Investigation study.

2.0 Methods

2.1 Literature Search

Science Applications International Corporation (SAIC) conducted a literature search of relevant environmental investigations and cleanups on properties and sediment associated with Budd Inlet. The literature search included:

- Online search of Ecology documents,
- Document search and request of archived documents at Ecology Headquarters, and
- Online search for other documents related to Budd Inlet (e.g., Hardel Plywood fire).

A list of available and reviewed documents are summarized in Table 1. Review forms (Appendix A) were completed for each relevant document and provide a summary of site histories, potential sources, site characterizations, sampling activities, and findings.

2.2 Electronic Data Search

A significant amount of environmental data for Budd Inlet was also available electronically. SAIC conducted a search of the available electronic data and included the following data sources:

- Ecology's Environmental Information Management (EIM) database search by location;
- Puget Sound Ambient Monitoring Program (PSAMP) data not included in EIM;
- Sediment Quality data not included in EIM;
- Dredged Analysis Information System (DAIS) data query request to the Dredged Material Management Program (DMMP)/U.S. Army Corps of Engineers (USACE), Seattle District;
- Port of Olympia computer-aided design (CAD) files; and
- City of Olympia CAD files.

Table 2 provides a list of studies obtained and reviewed. The vast majority of information obtained from this search consisted of sediment chemistry results. In many instances, environmental data obtained from the EIM database did not include the data summary report associated with the original investigation, or the data report could not be obtained within the timeframe of this study. In these instances, the EIM database is listed as the source and reference for the studies.

Sediment chemistry data obtained from the EIM database were screened against the Washington State Sediment Management Standards (SMS) Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL). Data were total organic carbon (TOC) normalized as needed for comparison. When TOC results were not available, the closest available TOC values in the region were utilized. In many cases, historic detection limits for some analytes (especially hexachlorobutadiene, hexachlorobenzene, and phenol compounds) exceeded the current SQS criteria.

Table 1. Literature Search Document Summary

Document Review Form	Title	Focus Area	EIM Study ID	Matrix	Author	Agency	Date	Summary
1	Chemical Characterization of Stormwater Runoff from Three Puget Sound Boatyards	Swantown	AJOH0049	Sediment, Stormwater	Johnson, A., S. Golding, and R. Coots	Ecology	December 1, 2006	The results of stormwater runoff and stormwater outfall sediments at three Puget Sound boatyards, including Swantown Boatworks, compared to Washington State water and sediment quality standards.
6	South Puget Sound Verification of 303(d) Listings for Chemical Contaminants in Fish and Shellfish	Cascade Pole	BERA0003	Tissue	Era-Miller, B.	Ecology	July 2006	Concentrations of polynuclear aromatic hydrocarbons (PAHs) and dioxin in mussel tissue from the Cascade Pole cleanup site collected following the sediment remediation.
7	Post Construction Sediment Compliance Monitoring - Cascade Pole Site, Olympia, Washington	Cascade Pole		Sediment	Landau	Port of Olympia	December 18, 2004	This document presents findings from the 2002 sediment compliance monitoring performed following removal and backfilling of the sediment remediation area.
11	Verification of 1998 303(d) PCB Listing, Inner Budd Inlet	Budd Inlet	SGOL004	Tissue	Golding, S.	Ecology	April 2003	To verify 303(d) listing, the report presents Inner Budd Inlet mussel tissue collection and polychlorinated biphenyl (PCB) analysis data.
14	Sediment Quality in Puget Sound: Year 3, Southern Puget Sound	Puget Sound		Sediment	Long, E., M. Dutch, S. Aasen, K. Welch et al.	Ecology	July 2002	As part of a three-year study by Ecology and the National Oceanic and Atmospheric Administration (NOAA), surface sediments from southern Puget Sound were collected in 1999, including Budd Inlet and Port of Olympia. Results from toxicity, chemistry, and benthic assemblage evaluations are presented.

Table 1. Literature Search Document Summary (continued)

Document Review Form	Title	Focus Area	EIM Study ID	Matrix	Author	Agency	Date	Summary
17	Lower Budd Inlet Sediment Characterization Study/ Midwest Site Evaluation & Chemical Screening of Selected Point Sources	Budd Inlet	BUDD INLET	Sediment	Norton, D.	Ecology	January 1999	Chemical and biological testing of sediments from 14 locations in Inner Budd Inlet occurred to re-evaluate status as a contaminated sediment site.
18	Health Consultation: Cascade Pole and Lumber Company Thurston County, Washington	Cascade Pole			Paul Marchant	Department of Health	December 1, 2000	The document presents a summary of investigations, actions, and findings at the site and uses existing data from the Cascade Pole Sediments risk assessment (RA), remedial investigation (RI), and feasibility study (FS).
20	Draft Engineering Design Report - Sediment Cleanup Action, Cascade Pole Site, Olympia, Washington	Cascade Pole		Sediment	Landau	Port of Olympia	October 13, 2000	The document refers to Landau reports that describe a pilot dredging project, a hydrogeologic site investigation, and a spoils pile evaluation conducted since 1997.
25	Verification of 1998 303(d) PCB Listing, Inner Budd Inlet	Budd Inlet	SGOL004	Tissue	Steven Golding	Ecology	April 1, 2003	This document summarizes more intensive sampling of mussels conducted on September 6, 2002, to determine if the Inner Budd Inlet PCB listing continues to be warranted. PCB tissue data are included.
27	Risk Assessment - Sediments Operable Unit - Cascade Pole Site, Olympia, Washington	Cascade Pole		Sediment	Landau	Port of Olympia	October 28, 1998	This document is a baseline RA and identifies the constituents of concern (COC), presents exposure assessment, toxicity assessment, and risk characterization. COCs identified were volatile organics, PAH, phenols, and dioxins/furans.

Table 1. Literature Search Document Summary (continued)

Document Review Form	Title	Focus Area	EIM Study ID	Matrix	Author	Agency	Date	Summary
28	Feasibility Study Sediments Operable Unit, Cascade Pole Site, Olympia, Washington	Cascade Pole		Sediment	Landau	Port of Olympia	October 18, 1993	This document covers the site history and describes, in detail, the remedial alternatives for the sediments operable unit to the multiple benefits line (MBL) and a detailed analysis of each alternative.
29	Chemical Contaminants in Surface Runoff from the Abandoned Cascade Pole (Olympia) Wood Treating Facility	Cascade Pole		Stormwater	Dale Norton	Ecology	November 1, 1990	This document describes a runoff study to characterize surface water discharges at the Cascade Pole site. Detected compounds included dioxin congeners.
36	Data Report: Post-Sediment Remediation Dioxin Testing and Fish Tissue Monitoring, Cascade Pole Sediment Remediation Site, Olympia, Washington	Cascade Pole		Sediment/ Tissue	Landau	Port of Olympia	January 31, 2003	This report presents the dioxin results of 2002 post-construction surface sediment sampling (collected outside the MBL) and fish tissue collection (from within the MBL).
37	Additional Confirmational Monitoring, Post-Construction Sediment Compliance Monitoring Report, Cascade Pole Site, Olympia, WA.	Cascade Pole		Sediment	Landau	Port of Olympia	2003	This confirmatory monitoring report is a follow-up to the initial April 2002 Post-Construction Sediment Compliance Monitoring and summarizes the findings of interior backfill sampling from locations of 2002 dredge interface exceedances.

Table 1. Literature Search Document Summary (concluded)

Document Review Form	Title	Focus Area	EIM Study ID	Matrix	Author	Agency	Date	Summary
38	Cleanup Action Plan, Cascade Pole Company Site - Sediments Operable Unit	Cascade Pole		Sediment	Ecology	Ecology	March 8, 2000	The Cleanup Action Plan (CAP) was prepared to satisfy the requirements of the Model Toxics Control Act (MTCA) and describes the Cascade Pole site, identifies site-specific cleanup standards for the sediments operable unit, and summarizes the remedial alternatives.

Table 2. Electronic Data Search Study Summary

Study Name	Year	Matrix	Chlorinated Aromatics	HPAH	LPAH	Metals	Miscellaneous Extractables	Pesticides	Phenol	Phthalates	VOA	Xylene
Toxics in stormwater runoff from Puget Sound boatyards	2006	Sediment	X	X	X	X	X		X	X		
South Puget Sound Fish and Shellfish Tissue Verification of 303(d) Listings	2005	Tissue		X	X		X		X	X		
Coastal EPA/EMAP 00	1999	Sediment	X	X	X	X	X	X	X	X		
BUDD INLET	1998	Sediment	X	X	X	X	X		X	X		
Budd Inlet Sediment Survey Project	1998	Sediment	X	X	X	X	X		X	X		
LOTT 1996 NPDES Sediment Monitoring Report	1996	Sediment	X	X	X	X	X	X	X	X		
WSPMP 1995 Pesticides and PCBs in Marine Mussels	1995	Tissue	X					X				
1992 LOTT Budd Inlet Sample Study	1992	Sediment				X			X			
DNR Aquatic Lands Sediment Quality Reconnaissance	1992	Sediment	X	X	X	X	X		X	X		
Indian/Moxlie Cr. (Olympis) Basin Samp.	1992	Sediment	X	X	X	X	X		X	X		
Cascade Pole Remedial Investigation, Sediment Toxicity Assessment	1991	Sediment		X	X	X	X		X			
LOTT Olympia Treat. Plant Outfall, DY91	1991	Sediment				X						
Olympia/West Bay marina sampling	1991	Sediment				X						
LOTT Olympia Treat. Plant Outfall, DY89	1989	Sediment	X	X	X	X	X	X	X	X	X	X
Olympia Harbor planning, full character	1988	Sediment	X	X	X	X	X	X	X	X	X	X
Olympia Harbor Berth 3 reconstruction dredging	1986	Sediment		X		X		X				
Olympia Harbor Berth 2 sediment study	1985	Sediment		X	X	X	X			X		
One Tree Island (Fiddlehead) Marina Project	1985	Sediment	X	X	X	X	X			X		

HPAH high molecular polynuclear aromatic hydrocarbon
LPAH low molecular polynuclear aromatic hydrocarbon
VOA volatile organic aromatic

3.0 Summary of Existing Data and Data Gaps

For the purposes of this report, Budd Inlet environmental data are summarized into three areas: East Bay, West Bay, and North Inlet (Figure 1). In addition, two sub-areas (Cascade Pole and the Olympia Harbor Navigation Channel and Turning Basin) are also described separately due to the focused environmental investigations conducted in these areas. Each area is addressed by summarizing the studies performed there (literature and electronic data summaries), identification of data gaps, and recommendations for future sampling.

Where possible, dioxin and furan congener data for Budd Inlet studies were reported as toxic equivalent quotients (TEQs). The concentration of dioxin/furan compounds were normalized to the toxicity of 2,3,7,8-TCDD using toxic equivalent factors (TEFs) updated by the World Health Organization in 2005 (Van den berg et al. 2006). The TEQ is equivalent to the sum of the concentrations of individual congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). Non-detected values were treated as half of the method detection limit. Based on the supplemental suitability determination for the Olympia Harbor Navigation Channel and Turning Basin dredging project (DMMP 2006), "background" screening concentrations for the Anderson/Ketron dredged material disposal site consist of a Tier 1 maximum concentration threshold of 7.2 picograms (pg)/g TEQ, and a Tier 2 volume weighted mean concentration threshold of 3.8 pg/g TEQ.

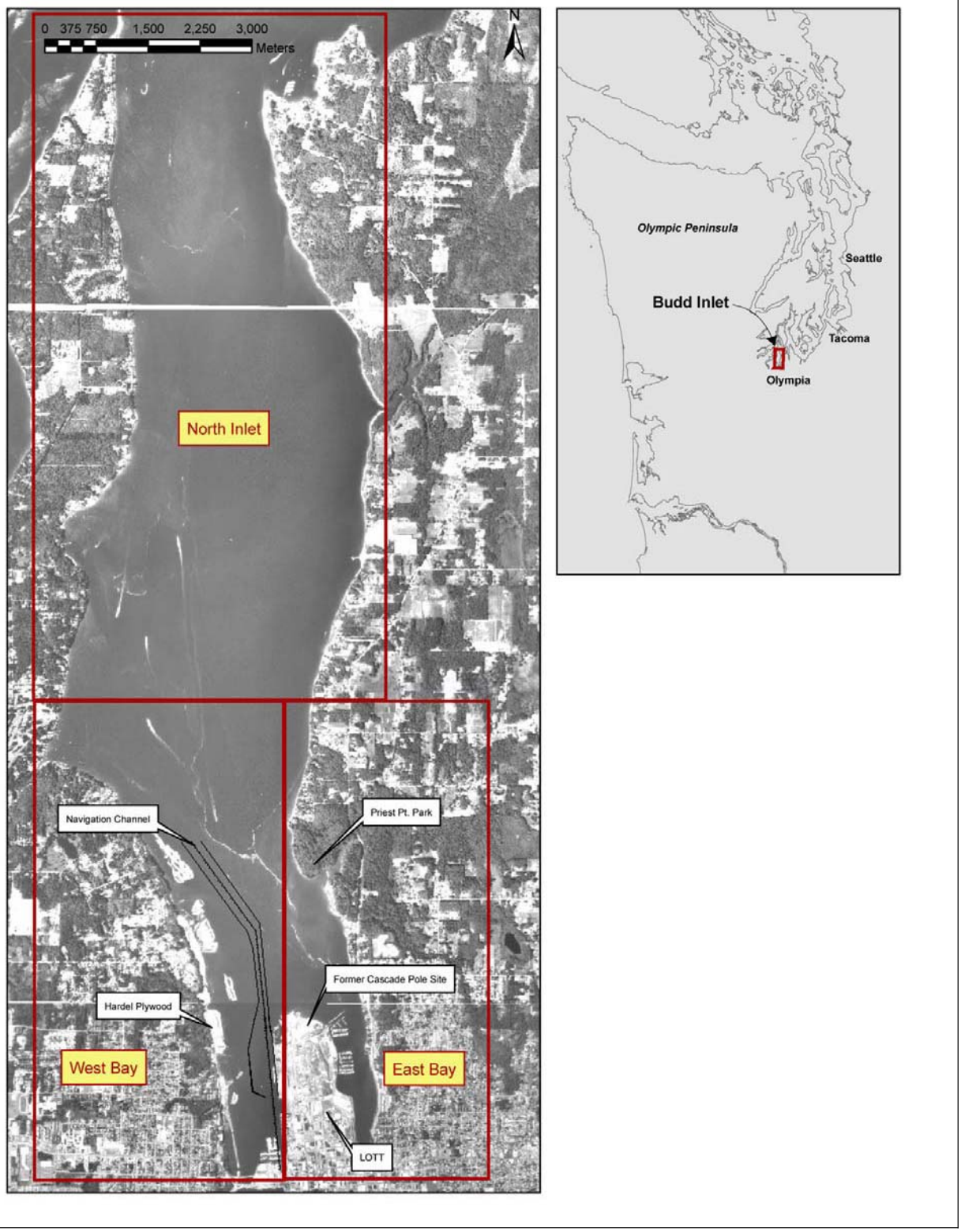

Figure 1. Budd Inlet Site Overview

3.1 East Bay

The boundaries of the East Bay area of Budd Inlet are identified in Figure 1. Areas of interest in East Bay based on previous environmental investigations include the Indian/Moxlie Creek basin, Swantown Boatworks and outfall, the Cascade Pole site (sub-area addressed in Section 3.2), and the Lacey, Olympia, Tumwater, and Thurston County (LOTT) outfall and diffuser, which discharges into Budd Inlet just west of the Cascade Pole site. The relevant documents and electronic data sets for East Bay are summarized in the following sections.

3.1.1 Literature Search Summary

This section presents brief summaries of environmental studies identified in the literature search that are relevant to East Bay. Detailed summaries are provided in Appendix A. The electronic data query results for East Bay are summarized in Section 3.1.2.

Ecology. 2006a. Chemical Characterization of Stormwater Runoff from Three Puget Sound Boatyards. December, 2006. Publication No. 06-03-041. Swantown Boatworks, located south of the Cascade Pole site, was among three boatyards examined in a study of petroleum, copper and other metals, organotins, semi-volatile organic compounds, and PCBs in stormwater runoff. Samples of stormwater runoff at Swantown Boatworks were collected during rain events in April and May of 2006 at the outfall pipe that delivers runoff to the wetland retention area. One surface (top 2 cm) sediment sample was also collected in February 2006 in the immediate vicinity of the stormwater outfall. The three metals measured at the highest concentrations in stormwater runoff—zinc, copper, and lead—were also the most predominant metals in the outfall sediments. Organotins were detected in Swantown runoff but not in sediments. The PCB Aroclors 1260 and 1254, dibenzofuran, benzoic acid, and PAHs were also detected in sediment. *Dibenzofuran exceeded the SQS criteria.*

Norton, D. 1986. Results of Priority Pollutants Analyses on Water, Sediment, and Clam Samples Collected in Lower Budd Inlet Near McFarland Cascade, Olympia, WA. August 14, 1985. Water, sediment, and clam tissue samples were analyzed to further delineate creosote and pentachlorophenol contamination in the vicinity of the Cascade Pole site. Clam tissue samples consisted of native littleneck and manila clam collected at Priest Point Park, soft shell clam samples at the Cascade Pole site, and native littleneck clam samples at Olympia Marina (west of Cascade Pole). Clams collected from Cascade Pole contained elevated PAHs in the range of values seen at the Eagle Harbor Superfund site. Clams collected at Olympia Marina were an order of magnitude lower, similar to urban embayments in Puget Sound. PAHs were undetected in Priest Point Park clams. Note: Although data results from this study are considered dated, the historical locations for intertidal clam samples were considered relevant to this investigation.

3.1.2 Electronic Data Summaries

This section summarizes the electronic data query results for studies conducted in the East Bay area. Chemical compounds that exceeded the SQS or CSL sediment standards are summarized in Table 3 and presented in Figure 2.

Sediment

EIM. 1999. Coastal Environmental Protection Agency/Environmental Monitoring and Assessment Program (EPA/EMAP) 00. Study ID CEMAP00. One routine Coastal EPA/EMAP 00/PSAMP sediment sample was collected in 1999 at the south end of the navigation channel, just north of the reported Swantown outfall. Analysis was performed for butyltins, chlorinated aromatics, PAH, metals, miscellaneous extractables, PCBs, pesticides, phenols, and phthalates. *Benzoic acid, bis(2-ethylhexyl)phthalate, and dibenzofuran exceeded the SMS criteria.*

EIM. 1998. Budd Inlet 1998 Study. Study ID BUDD98. This study included one sediment sample at the south end of East Bay and was analyzed for chlorinated aromatics, PAHs, metals, miscellaneous extractables, phenols, PCB, and phthalates. *Phthalates, PAHs, and dibenzofuran exceeded the SMS criteria.*

EIM. 1992a. 1992 LOTT Budd Inlet Sample Study. Study ID LOTT_92. One sediment sample was collected north of the Cascade Pole remediation area (EBAYMARNS004) as part of a source control study. Analysis included cresol compounds, phenol, and metals. *Current SMS criteria were not exceeded.*

EIM. 1992b. Indian/Moxlie Creek (Olympis) Basin Sampling Study. Study ID IND_MOXL. This study collected two sediment samples from the south end of the East Bay and analysis was performed for chlorinated aromatics, PAHs, metals, miscellaneous extractables, phenols, and phthalates. *Phthalates and dibenzofuran exceeded the SMS criteria*.

EIM. 1991. Cascade Pole Remedial Investigation, Sediment Toxicity Assessment. Study ID CASCADRI. Sediment reference samples for the Cascade Pole 1990–1991 RI were collected just south of the East Bay navigation channel near Swantown boatworks, and near Priest Point Park just south of Ellis Creek. Analysis included PAH, metals, phenols, and miscellaneous extractables as well as dioxin/furan analysis.[1] *Both sample locations exceeded current SMS criteria for dibenzofuran.*

Tissue

EIM. 2002. Verification of 303(d) PCB Listing for Inner Budd Inlet Study. Study ID SGOL004. This study collected mussel tissue samples in the south end of the East Bay and inside the mouth of Ellis Creek, near Priest Point Park. Both samples were analyzed for PCBs, and in each sample PCB 1254 was the only detected congener of the seven analyzed for.

EIM. 1995. WSPMP 1995 Pesticides and PCBs in Marine Mussels. Study ID WSPMP95M. A mussel tissue sample was collected at one station in the south end of the East Bay near Moxlie Creek and analyzed for PCBs, insecticides, and pesticides. The analytes 4,4'-DDE, PCB-aroclor 1254, trans-Nonachlor, and trans-Chlordane were detected.

[1] The units for the dioxin data results are suspect; findings are not verifiable without the original Remedial Investigation and Supplemental Site Investigation documents.

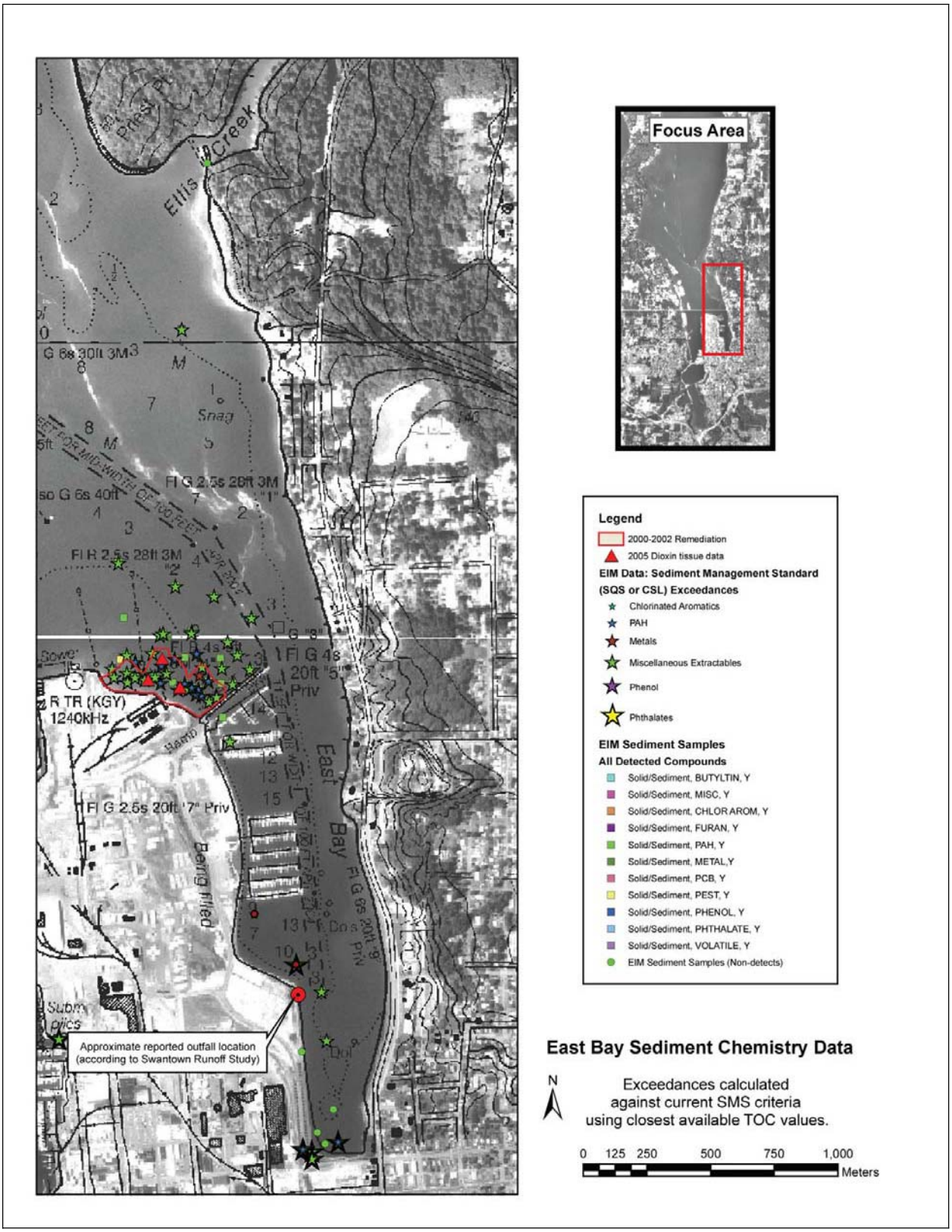

Figure 2. East Bay Area of Budd Inlet Sediment Chemistry Data

Table 3. Summary of East Bay Studies and Sediment Chemistry Parameters that Exceed SMS Criteria

Study Name	Year	HPAH	LPAH	Metals	Miscellaneous Extractables	Phthalates
Chemical Characterization of Stormwater Runoff from Three Puget Sound Boatyards	2006				X	
Coastal EPA/EMAP 00	1999				X	X
PSAMP	1999				X	
Budd Inlet Sediment Survey Project	1998	X	X		X	X
Indian/Moxlie Creek (Olympis) Basin Sampling	1992				X	X
Cascade Pole Remedial Investigation, Sediment Toxicity Assessment – Background Reference Samples only	1990–1991				X	

3.1.3 Data Gaps and Sampling Recommendations

Dioxins and Furans. Sediments in the East Bay area (with the exception of the Cascade Pole site; see Section 3.2) have not been sampled for dioxins and furans and require further investigation. Offshore areas near Priest Point Park are recommended for dioxins and furans analysis, based on reports of dredged material placement near the park in 1973 (R. McMillan 2006, personal communication). The dredged material originated from maintenance dredging of the federal navigation channel. Tissue (bivalves) collection and analysis is recommended at Priest Point Park.

SMS Chemicals of Concern. In the last 10 years, PAHs, miscellaneous extractables, and phthalates have been detected in East Bay sediments at levels that exceed SQS criteria. Confirmatory gradient testing of SMS chemicals of concern near potential point sources may be warranted.

3.2 Cascade Pole

A remedial investigation (RI), supplemental site investigation (SSI), and feasibility study (FS) were performed for the Cascade Pole sediment site from 1985 to 1993 to characterize the extent of contamination and perform a detailed analysis of remedial alternatives. The Cascade Pole site is located at the north end of the peninsula in the East Bay area (see Figure 2).

Although the RI and SSI were not available at the time of this review, the major findings of the investigations were summarized in other documents. The data from these studies were also available through an EIM database search. However, data older than 10 years were generally disregarded unless they identified a potential source of current contamination. In addition, a remedial action was conducted at the Cascade Pole site from 2000 to 2002, and pre-remediation Cascade Pole RI data were not considered valid. Site information was also gathered from figures and CAD files provided by the City of Olympia and Port of Olympia.

3.2.1 Literature Search Summary

This section presents brief summaries of four recent environmental studies identified in the literature search that are relevant to the Cascade Pole site. Landau Associates, Inc. (1998, 2000) provide summaries of the Cascade Pole RI findings and describe the remedial actions taken. Landau and Associates (2003a, 2003b, 2004) and Ecology (2006b) provide environmental monitoring results at the Cascade Pole site following remediation. Detailed summaries of the studies are provided in Appendix A. The electronic data query results for Cascade Pole are summarized in Section 3.2.2.

Landau Associates, Inc. 1998. Construction Documentation Report: Interim Remedial Action Proposed Cutoff Wall and Storm Drain Remediation - Cascade Pole Site, Olympia, Washington. This document summarizes the construction schedule, operations, and maintenance costs of the interim remedial action at Cascade Pole in 1996 and 1997. The site history section states that contaminated sediments were discovered in 1983 and led to several investigations, including the RI of the upland portion of the site in 1985 by AGI, an FS of the upland portion of the site in 1988 by AGI, and 1992 Supplemental Site Investigations (SSI) by Environmental Science and Engineering, Inc. (onshore) and Landau Associates, Inc. (sediment). The site was listed under MTCA in 1990. Interim remedial action included groundwater treatment and extraction of light non-aqueous phase liquid (LNAPL) (12/1992) and of dense non-aqueous phase liquid (DNAPL) using a trench (2/1993). In November and December 1993, a steel sheet pile barrier wall was installed "…to minimize transport of DNAPL to the East Bay of Budd Inlet…."

Landau Associates, Inc. 2000. Draft Engineering Design Report - Sediment Cleanup Action, Cascade Pole Site, Olympia, Washington. This document provides a history of site activities and description of previous investigations. The majority of the document is a detailed description of the remedial action plans for the intertidal area (Figure 4). A summary of 1993 RI findings by Landau Associates, Inc., included a description of lateral and vertical distribution of creosote-related contamination:

- Contamination in the sediments operable unit extends laterally from the former wood treatment log pond to the east and, to a lesser extent, to the north and northeast.
- Vertical sediment contamination was found at the highest concentrations in the 10–55 cm and 55–100 cm depth intervals. Contamination was found to be vertically limited by an underlying silt and clay layer.
- Pentachlorophenol (PCP)-related sediment contamination was found in the shoreline northwest of the wood treatment area and appeared to be from runoff, former seeps, and/or a stormwater pipeline along the northern shore.

Ecology. 2000. Cleanup Action Plan. Cascade Pole Company Site - Sediments Operable Unit. The CAP describes the Cascade Pole site, including the history and extent of contamination, identifies site-specific cleanup standards for the sediments operable unit and interim remedial actions, and summarizes the remedial alternatives presented in the Sediments FS. This document identifies and describes in detail the selected remedial alternative for the sediments operable unit.

Much of the information from the RI and the Draft Engineering Design Report (Landau 2000) is summarized in this document, including a description of the lateral and vertical distribution of contamination. The CAP also describes two sediment surface water exceedance issues (from pooled or flowing water in channels of sediment): 1) dioxin above the federal criteria that address human consumption of marine fish in all site water samples (as well as those taken elsewhere in Budd Inlet as a basis of comparison to site samples) collected during the RI; and 2) the exceedance of health-based water quality criteria for six PAHs from a drainage channel, just east of the former wood treatment plant.

Landau Associates, Inc. 2003a. Additional Confirmational Monitoring, Post-Construction Sediment Compliance Monitoring Report, Cascade Pole Site, Olympia, WA. This confirmatory monitoring report is a follow up to the 2002 Post-Construction Sediment Compliance Monitoring Report and documents the conditions where three dredge interface samples exceeded cleanup levels or cleanup action levels during the inital monitoring. Under the monitoring approach, interior backfill material from each of three locations were analyzed. Concentrations in the backfill material were below cleanup levels. Therefore, the results were considered in compliance.

Landau Associates, Inc. 2003b. Data Report. Post-Sediment Remediation Dioxin Testing and Fish Tissue Monitoring, Cascade Pole Sediment Remediation Site, Olympia, WA. This report presents the results of post-construction fish tissue and sediment dioxin testing near the Cascade Pole site. Three juvenile chinook salmon tissue samples and nine surface sediment samples (within 3,000 feet of the remediation area) were analyzed for dioxin. Salmon tissue dioxin concentrations ranged from 0.028 to 0.679 pg/g TEQ. Surface sediment concentrations ranged from 0.510 pg/g TEQ at station CP-21-S (near Priest Point Park) to 22.4 pg/g TEQ at station CP-25-S (northeast of the Cascade Pole site).

Landau Associates, Inc. 2004. Report: Post-Construction Sediment Compliance Monitoring Report, Cascade Pole Site, Olympia, WA. This monitoring report documents sampling activities in 2002 to verify that cleanup action levels were achieved during the dredging and backfill remediation performed from 2000 through 2002 and to monitor progress of natural

recovery. Sediment compliance monitoring was performed following removal and backfilling of the area within the multiple benefits line (MBL).

The report states that surface samples beyond the MBL were below cleanup levels. The report also concluded that although COCs were present above cleanup levels at three locations at the dredge interface, the overlying backfill was below cleanup levels. Dioxin TEQs for the 2002 compliance monitoring study are presented in Figure 3. Subsurface dredged-interface dioxin TEQs within the MBL ranged from 3.1 to 97.1 pg/g. Backfill samples were archived. Surface samples (0–10 cm) within the MBL had dioxin TEQs ranging from 3.2 to 61.4 pg/g. Surface samples collected outside the MBL had dioxin TEQs ranging from 8.9 to 21.8 pg/g. One archived backfill sample was analyzed and had a low dioxin TEQ of 3.13 pg/g. The collection of additional monitoring core samples was recommended for the spring of 2003, but the report for that sampling event was not available at the time of this investigation.

Ecology. 2006b. South Puget Sound Verification of 303(d) Listings for Chemical Contaminants in Fish and Shellfish. Publication 06-03-026. Three composite samples of bay mussels (*Mytilus trossulus*) were collected from the Cascade Pole intertidal cleanup/excavation site (Figure 3) and analyzed for 303(d)-listed contaminants: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(k)fluoranthene. At the request of Ecology's Toxics Cleanup Program, additional PAHs, PCP, and dioxin/furans were also analyzed.

Four listed PAH chemicals (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene) were found to exceed the National Toxics Rule (NTR) criterion of 0.93 µg/kg wet weight. Two other chemicals—benzo(a)pyrene and indeno(1,2,3-cd)pyrene—also exceeded NTR criteria. All six chemicals were recommended for inclusion in Category 5 of the 303(d) List. The majority of the 17 dioxin/furan congeners were detected. However, NTR human health criteria have only been developed for the 2,3,7,8-TCDD congener (0.07 pg/g, ppt). The NTR criterion was exceeded for only one of the three samples (3-Close). TEQ values for dioxins and furans were also found to exceed the NTR criterion for 2,3,7,8-TCDD. Inner Budd Inlet was recommended for inclusion in Category 5 of the 303(d) List for 2,3,7,8-TCDD in mussel tissue.

3.2.2 Electronic Data Summaries

Electronic data queries for the Cascade Pole site included a search for environmental data outside the MBL predating the 2000–2002 remedial action. This search identified Cascade Pole RI data and LOTT outfall monitoring data. However, dioxin/furan analysis in sediments was not included.

EIM. 1990. Cascade Pole Remedial Investigation, Sediment Toxicity Assessment. Study ID CASCADRI. Cascade RI data from 1990 and 1991 collected north of the MBL included PAH, phenols, and miscellaneous extractables, but did not include dioxin analysis.

EIM. 1989, 1992b. 1989 LOTT Olympia Treatment Plant Outfall Study. Study ID LOTTDY89. 1992 LOTT Budd Inlet Sample Study. Study ID LOTT_92. LOTT 1989 and LOTT 1992, which each sampled one location north of the Cascade Pole MBL for chlorinated aromatics, PAHs, metals, PCB, pesticides, phenols, phthalates, and VOAs. Dioxin analysis was not included.

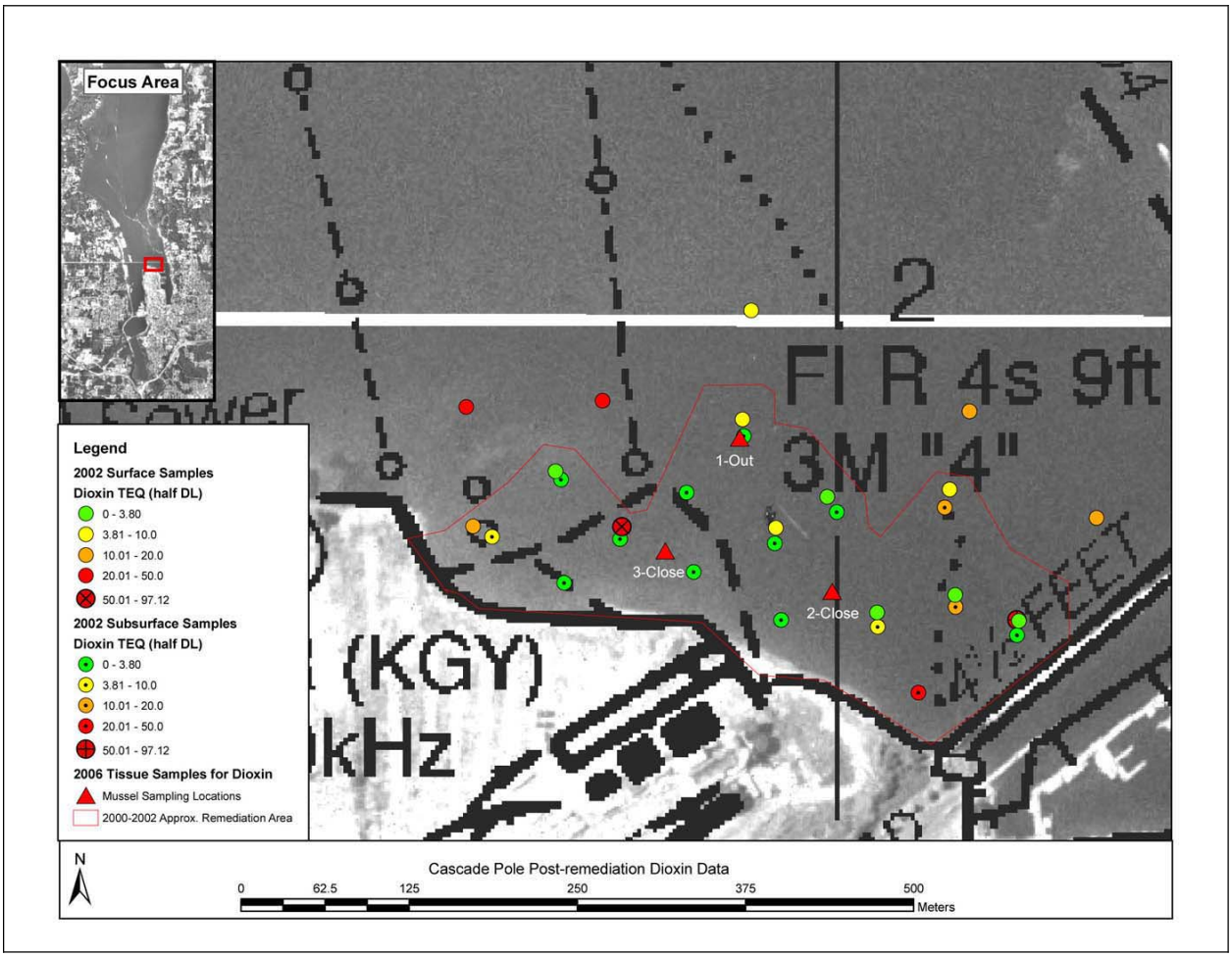

Figure 3. Post-remediation Sediment and Tissue Samples Collected at the Cascade Pole Site

3.2.3 Data Gaps and Sampling Recommendations

Dioxins and Furans. Since the excavation and fill of the sediments operable unit at the Cascade Pole site was completed in 2002, dioxin has been measured in both sediment and tissue samples in the remediated area within the MBL and to a lesser extent outside the remediated area. In the RI and SSI, vertical sediment contamination was found at the highest concentrations in the 10–55 cm and 55–100 cm depth intervals and contamination was found to be limited by an underlying silt and clay layer. However, subsurface areas outside the MBL have no dioxin data available. Therefore, dioxin and furan analysis is recommended for surface and subsurface sediments outside of the MBL.

It was found in the RI and SSI that contamination in the sediments operable unit extends laterally from the former wood treatment log pond to the east and, to a lesser extent, to the north and northeast. However, there are no data directly east of the former wood treatment pond. Confirmatory dioxin and furan analysis of surface and subsurface sediments is recommended.

Gradient testing of dioxins and furans in surface sediments is recommended near the LOTT outfall.

3.3 West Bay

The boundaries of the West Bay area of Budd Inlet are identified in Figure 4. Areas of interest in West Bay based on previous environmental investigations include Fiddlehead Marina and the LOTT emergency outfall, the Olympia Harbor federal navigation channel and Port of Olympia turning basin (addressed separately in Section 3.4), the Hardel Plywood site, and West Bay Marina. The relevant documents and electronic data sets for West Bay are summarized in the following sections.

3.3.1 Literature Search Summary

This section presents brief summaries of environmental studies identified in the literature search that are relevant to West Bay. Detailed summaries are provided in Appendix A. The electronic data query results for West Bay are summarized in Section 3.3.2.

Ecology and NOAA. 2002. Sediment Quality in Puget Sound: Year 3, Southern Puget Sound. July 2002. The purpose of this study was to determine the surface sediment quality throughout Puget Sound by measuring chemical contamination, toxicity testing, and benthic community analysis. The samples collected for Puget Sound included sediments from Budd Inlet and Port of Olympia. Actual sampling locations are provided in Appendix A (DOC 14 Maps). Samples were collected at the north end of Budd Inlet, in the East Bay, and near the Port of Olympia. Sediment chemistry data results exceeded SMS criteria for benzoic acid, benzyl alcohol, and phenol in samples from the Port of Olympia.

The report noted that the two samples from the Port of Olympia were the most toxic among South Puget Sound samples in larval development toxicity tests and that the degree of toxicity diminished rapidly seaward into Budd Inlet, where none of the samples were toxic.

Other toxicity findings near the Port of Olympia were:

- A very toxic un-ionized ammonia porewater concentration of 398.6 ug/L;
- Severe responses in the toxicity tests potentially driven by PAH and, to a lesser degree, chlorinated chemicals; and
- The two samples from Port of Olympia had benthic results scoring 0 in benthic evaluations as they contained no living organisms whatsoever.

Ecology. 1999. Lower Budd Inlet Sediment Characterization Study. February 1999. To determine if this area should still be listed on the Washington State Department of Ecology Contaminated Sediment Site List, sediments were collected from 14 locations near potential sources in lower Budd Inlet in June 1998.

Sampling locations were selected based on the following:

- Six sites in the midwest portion of the turning basin to evaluate listing as a contaminated site;
- Two sites near the former Hardel Plywood site drains to evaluate suspected contamination adjacent to historical drain;

- One site near Fiddlehead Marina to evaluate contamination levels near the LOTT emergency outfall;
- Two sites near West Bay Marina to screen for impacts from boatyard runoff;
- One site near Berth B Log Terminal to evaluate sediments adjacent to port dock; and
- One site near Moxlie Creek in the south end of the East Bay to screen for discharge impacts.

Analysis was performed for metals and organics, and based on the potential sources, butyltin concentrations were only measured at the two marina locations (West Bay Marina and near the Fiddlehead Marina).

In general, metal concentrations at all stations in Budd Inlet were low and similar to the reference site and concentrations of most organic compounds were low.

SMS exceedances and peak concentrations of coprostanol and bis(2-ethyl hexyl)phthalate were present near the Fiddlehead Outfall. The Fiddlehead Outfall was used as a sewage bypass for the LOTT treatment plant during high flow events. Discharge was reduced in 1997, but as of this report, stormwater was still discharged through the outfall. According to the study, the distribution of LPAH and HPAH compounds in lower Budd Inlet sediment indicated that historical PAH sources are primarily responsible for the PAH contamination observed.

3.3.2 Electronic Data Summaries

This section summarizes the electronic data query results for studies conducted in the West Bay area. Sediment and water data have been collected throughout the area with available data going back to 1985. No tissue data were identified. Chemical compounds that exceeded the SQS or CSL sediment standards are summarized in Table 4 and presented in Figure 4.

PSAMP. 1999. Puget Sound Ambient Monitoring Program. One PSAMP sediment sample was collected at the north end of the turning basin in 1999. Analysis included base/neutral/acid (BNA), butyltins, chlorinated aromatics, metals, PAH, pesticides, phenols, phthalates, and volatile organics. *Phenol and dibenzofuran exceeded SMS criteria*.

EIM. 1998. Budd Inlet Sediment Survey Project 1998. Study ID BUDD98. Sediment samples were collected at several locations in the turning basin, two locations near Hardel Plywood (post-fire), and two locations near the West Bay Marina. The samples were analyzed for butyltin, chlorinated aromatics, PAHs, metals, and phthalates. Phthalates, phenols, and miscellaneous extractables were found in exceedance of SMS criteria at a small number of stations. *Benzoic acid and dibenzofuran measured at concentrations exceeding SMS criteria at the majority of sampling locations.*

EIM. 1996. LOTT 1996 NPDES Sediment Monitoring Report. Study ID LOTT_96. Sediment samples were collected from two transects away from the emergency outfall on the east side of West Bay and the north end of the turning basin. Analysis included chlorinated aromatics, mirex, PAHs, metals, PCB, and phthalates. *Bis(2-Ethylhexyl)phthalate and dibenzofuran exceeded SMS criteria.*

EIM. 1992. DNR Aquatic Lands Sediment Quality Reconnaissance. Study ID DNRREC92. Three sediment samples were collected in the West bay area of Budd Inlet along the west shoreline, one south of Hardel Plywood, and two near the West Bay Marina. Analysis included chlorinated aromatics, PAHs, metals, miscellaneous extractables, PCB, phenols, and phthalates. *Dibenzofuran exceeded SMS criteria at two of the three stations: near Hardel Plywood and near the south end of West Bay Marina.*

EIM. 1991. Cascade Pole Remedial Investigation, Sediment Toxicity Assessment. Study ID CASCADRI. One Cascade Pole RI/SSI Background reference sample was collected in 1991 near Hardel Plywood. Analysis included PAH, metals, phenols, and miscellaneous extractables as well as dioxin/furan analysis. (The units for the dioxin data results are suspect and findings are not verifiable without the original RI and SSI documents.) *Dibenzofuran exceeded SMS criteria.*

EIM. 1988. Olympia Harbor Planning Full Characterization Study. Study ID OLYHAR88. 1988 sediment samples include one near the West Bay LOTT emergency outfall, approximately four stations in the center of West Bay, and a line of samples along the navigation channel continuing north to the convergence of the East Bay navigation channel. Analysis included chlorinated aromatics, PAHs, metals, pesticides, phenols, and phthalates. *Benzyl alcohol, dibenzofuran, and phthalates exceeded SMS criteria.*

EIM. 1992. Lott Budd Inlet Sample Study. Study ID LOTT_92. Three sediment samples were collected from a site in West Bay near the Fiddlehead Marina and from the north end of the navigation channel (MIDBUDD) where the east and west navigation channels converge. Analysis for conventionals, metals, miscellaneous extractables, and phenol was performed. *SMS criteria were not exceeded.*

EIM. 1985. One Tree Island (Fiddlehead) Marina Project. Study ID 1TREEISL. Fourteen sediment samples were collected near the Fiddlehead Marina on the east side of West Bay and the LOTT emergency outfall. Sediment was analyzed for chlorinated aromatics, PAH, metals, miscellaneous extractables, phthalates and PCB. *PAHs, metals, and phthalates exceeded SMS criteria.*

Table 4. Summary of West Bay Studies and Sediment Chemistry that Exceeds SMS Criteria

Study Name	Year	Chlorinated Aromatics	HPAH	LPAH	Metals	Miscellaneous Extractables	Phenols	Phthalates
Budd Inlet Sediment Survey Project	1998	X	X		X	X	X	X
LOTT 1996 NPDES Sediment Monitoring Report	1996					X		X
DNR Aquatic Lands Sediment Quality Reconnaissance	1992					X		
Cascade Pole Remedial Investigation, Background reference sample only	1990–1991					X		
Olympia Harbor planning, full characterization	1988					X		X
One Tree Island (Fiddlehead) Marina Project	1985		X	X	X			X

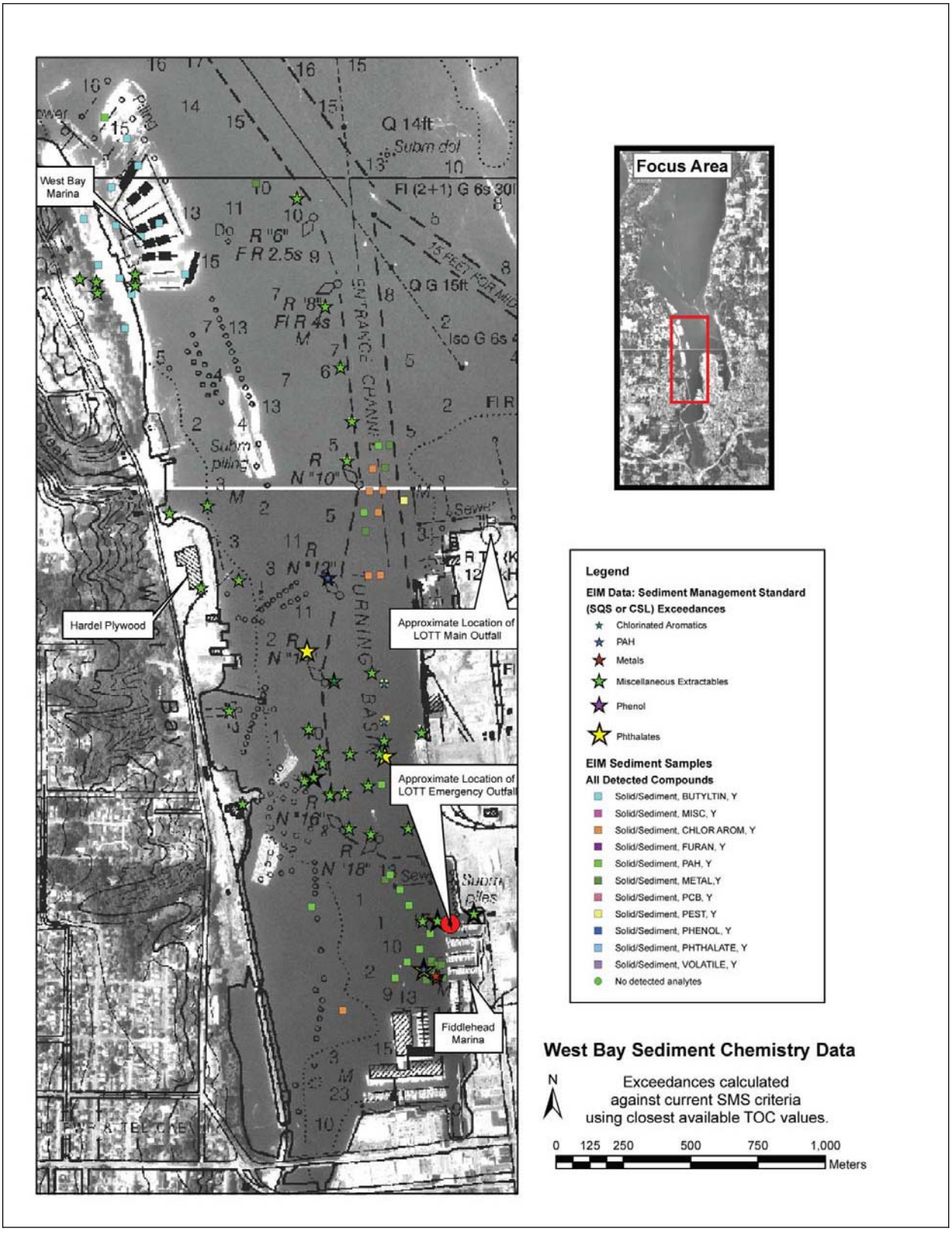

Figure 4. West Bay Area of Budd Inlet Sediment Chemistry Data

3.3.3 Data Gaps and Sampling Recommendations

Dioxins and Furans. With the exception of the Olympia Harbor Navigation Channel Dioxin Study in 2006 (see Section 3.4), dioxin and furan analysis has not been conducted in the West Bay area of Budd Inlet in either sediment or tissue. Potential point sources in West Bay area include runoff from the Hardel Plywood fire in 1996 and the LOTT emergency outfall located on the east side of the West Bay. Gradient testing of dioxins and furans in surface sediments is recommended near the the Hardel Plywood site and LOTT emergency outfall.

SMS Chemicals of Concern. Previous studies in West Bay have measured organic compounds and metals in sediments at levels that exceed SQS criteria. Confirmatory gradient testing of SMS chemicals of concern near potential point sources may be warranted.

3.4 Olympia Harbor Navigation Channel and Port of Olympia Turning Basin

DMMP sediment characterization studies have been conducted in support of maintenance dredging and minor widening of the Olympia federal navigation channel and the Port of Olympia's berthing area. This project is identified as the Olympia Harbor Navigation (OHN) project, and was conducted by the USACE, Seattle District, in cooperation with the Port of Olympia.

The OHN project underwent two rounds of sediment characterization in 1988: a Partial Characterization for purposes of considering a down-ranking, followed by a Full Characterization for the 535,185-cubic yard (cy) project. In 1999, the OHN project was expanded to 624,000 cy with the inclusion of the Port of Olympia's berthing area, and underwent another round of sediment characterization testing. In 2005, the DMMP granted a recency extension to the OHN project. Subsequent to this extension, the DMMP agencies were notified about dioxin/furan concerns in the Olympia Harbor/Budd Inlet area, and about dioxin results from the post-cleanup monitoring investigation at the Cascade Pole Model Toxics Control Act site. Therefore, in 2006, USACE initiated a dioxin/furan sediment characterization of the proposed dredged material from the OHN project.

3.4.1 Literature Search Summary

This section presents brief summaries of environmental studies identified in the literature search that are relevant to the Olympia Harbor navigation channel and Port of Olympia turning basin area. Detailed summaries are provided in Appendix A.

DMMP. 2006. Memorandum of Record: OHN Project Supplemental Suitability Determination. 1988 OHN Project Sediment Characterization. The OHN project initially underwent Puget Sound Dredged Disposal Analysis (PSDDA) testing in 1988. A Partial Characterization was conducted to evaluate the potential for down-ranking the project from a high rank. Nine samples were collected and analyzed during the Partial Characterization: five samples within the turning basin and four samples within the navigation channel. The result of this characterization was the re-ranking of the proposed project area into four sub-areas ranked high, high-moderate, moderate, and low-moderate for the Full Characterization. Analysis of the

Full Characterization data for 23 Dredged Material Management Units (DMMUs) found 12 of 23 DMMUs with chemical concentrations (nickel, cadmium, mercury, copper napththalene, pyrene, 2-methylphenol) that exceeded screening levels (SLs) using 1988 guideline values (Note: concentrations do not exceed the 1999 DMMP guidelines). Subsequent bioassay testing found that one DMMU (DMMU-Z; 9,000 cy) failed non-dispersive guidelines and was determined to be unsuitable for open-water disposal.

DMMP. 2006. Memorandum of Record: OHN Project Supplemental Suitability Determination. 1999 OHN Project Sediment Characterization. The Port of Olympia's berthing area was added to the OHN project for a total of 624,000 cy of proposed dredged material. A full sediment characterization was conducted with 17 DMMUs tested under a low ranking, although subsequent evaluation by the DMMP agencies has concluded that a high rank should have been maintained due to the bioassay hit in one DMMU at the head of the Turning Basin (DMMU-Z). The Port of Olympia's berthing area added to the project also did not have previous testing, and should have been tested at either a moderate or high rank. The results of the testing of the 17 DMMUs indicated that all chemicals of concern were below the SLs except tributyltin (TBT). TBT exceeded the SL in surface DMMUs in the Port's berthing area (B1) and in the Turning Basin Widening Area (TBW1). Bioaccumulation testing of these DMMUs found tissue levels of TBT below the risk-based target tissue levels (TTLs).

SAIC. 2006. Olympia Federal Navigation Channel and Port of Olympia Berthing Area Dioxin Sediment Characterization. Prepared for U.S. Army Corps of Engineers, Seattle District. Prepared by Science Applications International Corporation, Bothell, WA. Additional sediment sampling was conducted at the OHN project to evaluate dioxins and furans in the proposed dredged material. A total of 21 vibracores were collected by the USACE, Seattle District, to characterize 29 DMMUs for dioxins and furans. Approximately 238,234 cy of material exceed the DMMP dioxin interpretation framework Tier 1 maximum level of 7.3 pg/g TEQ (and exceed the Tier 2 Anderson/Ketron Island disposal site mean concentration of <3.8 pg/g TEQ). This material is unsuitable for unconfined open-water disposal, and must be disposed of at an Ecology-approved upland disposal site or in-water confined disposal site. Dioxin and furan concentrations are presented in Figure 5.

3.4.2 Electronic Data Summaries

This section summarizes the electronic data query results for studies conducted in the Olympia Harbor navigation channel and Port of Olympia turning basin area. Sediment and water data were collected throughout the area with available data going back to 1985. No tissue data were identified. Chemical compounds that exceeded the SQS or CSL sediment standards are summarized in Table 5 and presented in Figure 5.

EIM. 1985, 1986. Olympia Harbor Berth 2 and 3 Sediment Studies. Study IDs OLYMP_B2 and OLYMP_B3. Olympia Berth 2 and Berth 3 studies, conducted in 1985 and 1986 respectively, consisted of a total of five sediment samples collected near the center of the turning basin; analysis included PAHs, pesticides, miscellaneous extractables, metals, and phthalates. *PAHs and phthalates exceeded SMS criteria.*

3.4.3 Data Gaps and Sampling Recommendations

Dioxins and Furans. The 2006 OHN dioxin study measured elevated dioxin and furan TEQs in the upper 4 feet of surface sediments in the turning basin and portions of the navigation channel, including the farthest north portion of the channel. Therefore, dioxin and furan testing is recommended to the north of the navigation channel, to assess the spatial extent of dioxins and furans.

The potential for recontamination must be minimized if maintenance dredging and/or sediment cleanup activities are conducted within the navigation channel and turning basin. Therefore, dioxin and furan testing of surface and subsurface sediments along the periphery of the channel and turning basin is recommended.

Table 5. Summary of Previous Studies in the Olympia Harbor Navigation Channel and Port of Olympia Turning Basin, Dioxins and Furans, and Sediment Chemistry that Exceeds SMS Criteria

Study Name	Year	Dioxins and Furans	Chlorinated Aromatics	HPAH	LPAH	Metals	Miscellaneous Extractables	Phenols	Phthalates
Olympia Harbor Navigation Channel and Port of Olympia Berthing Area Dioxin Characterization	2006	X							
1999 OHN Project Sediment Characterization	1999					X			
Olympia Harbor planning, full characterization	1988						X		X
Olympia Harbor Berth 3 reconstruction dredging	1986			X					
Olympia Harbor Berth 2 sediment study	1985			X	X				X

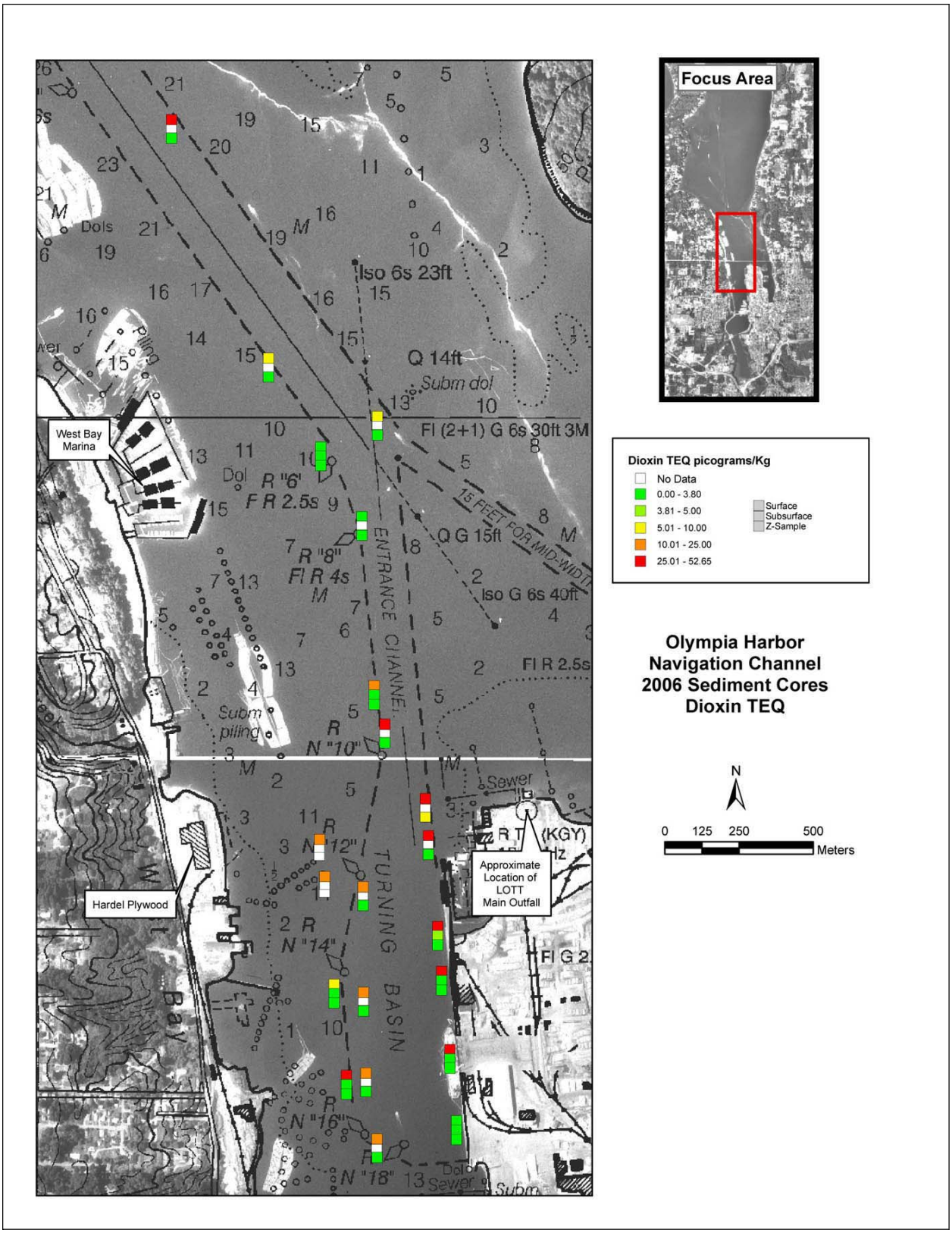

Figure 5. Olympia Harbor Navigation Channel and Port of Olympia Turning Basin Sediment Chemistry Data

3.5 North Inlet

The North Inlet area extends north of the Olympia Harbor navigation channel entrance to the mouth of Budd Inlet (see Figures 1 and 6).

3.5.1 Literature Search Summary

This section presents brief summaries of environmental studies identified in the literature search that are relevant to the North Inlet area. Detailed summaries are provided in Appendix A.

Ecology and NOAA. 2002. Sediment Quality in Puget Sound: Year 3, Southern Puget Sound. July 2002. This study, described in Section 3.3.1, included the collection of sediment samples from three locations in the north end of Budd Inlet. Sediment chemistry data results exceeded SMS criteria for benzoic acid and benzyl alcohol at one location.

3.5.2 Electronic Data Summaries

This section summarizes the electronic data query results for the North Inlet area. Potential sources for contamination were not identified for this area. Chemical compounds that exceeded the SQS or CSL sediment standards are summarized in Table 6 and presented in Figure 6.

PSAMP. 2007. Puget Sound Ambient Monitoring Program. PSAMP sampled one station annually from 2000 to 2005 (near the north end of the navigation channel) as part of a temporal study. PSAMP samples from 2000 and 2005 were analyzed for BNA, butyltins, chlorinated aromatics, metals, PAH, polybrominated diphenyl ether, PCB, pesticides, phenol, phthalates, and VOAs. All other years included conventionals analysis only. *SMS criteria were exceeded for benzoic acid and dibenzofuran in 2000 and 2005, and cadmium in 2005*.

EIM. 1999. Coastal EPA/EMAP 00. Study ID CEMAP00. One Coastal EPA/EMAP 00/ PSAMP routine ambient monitoring sediment sample was collected in 1999 in the middle of the Inlet at the north end for analysis of chlorinated aromatics, miscellaneous extractables, metals, butyltins, PCB Aroclors and congeners, PAH, pesticides, phenols, and phthalates. *The sample exceeded SMS criteria for benzyl alcohol and benzoic acid.*

EIM. 1992. DNR Aquatic Lands Sediment Quality Reconnaissance. Study ID DNRREC92. The study collected sediment from one location at the north end of the east shoreline of Budd Inlet for chlorinated aromatics, miscellaneous extractables, metals, PCB, PAH, phenols, and phthalates. *SMS criteria were not exceeded.*

3.5.3 Data Gaps and Sampling Recommendations

Dioxins and Furans. Dioxins and furans were not analyzed as part of the PSAMP monitoring efforts in the North Inlet area. Low density sampling for dioxin and furan analysis is recommended, with attention to gradient sampling near the Olympia Harbor navigation channel entrance.

Table 6. Summary of Previous Studies in North Inlet Area and Sediment Chemistry that Exceeds SMS Criteria

	Miscellaneous Extractables	Metals
Coastal EPA/EMAP 00	X	
PSAMP	X	X

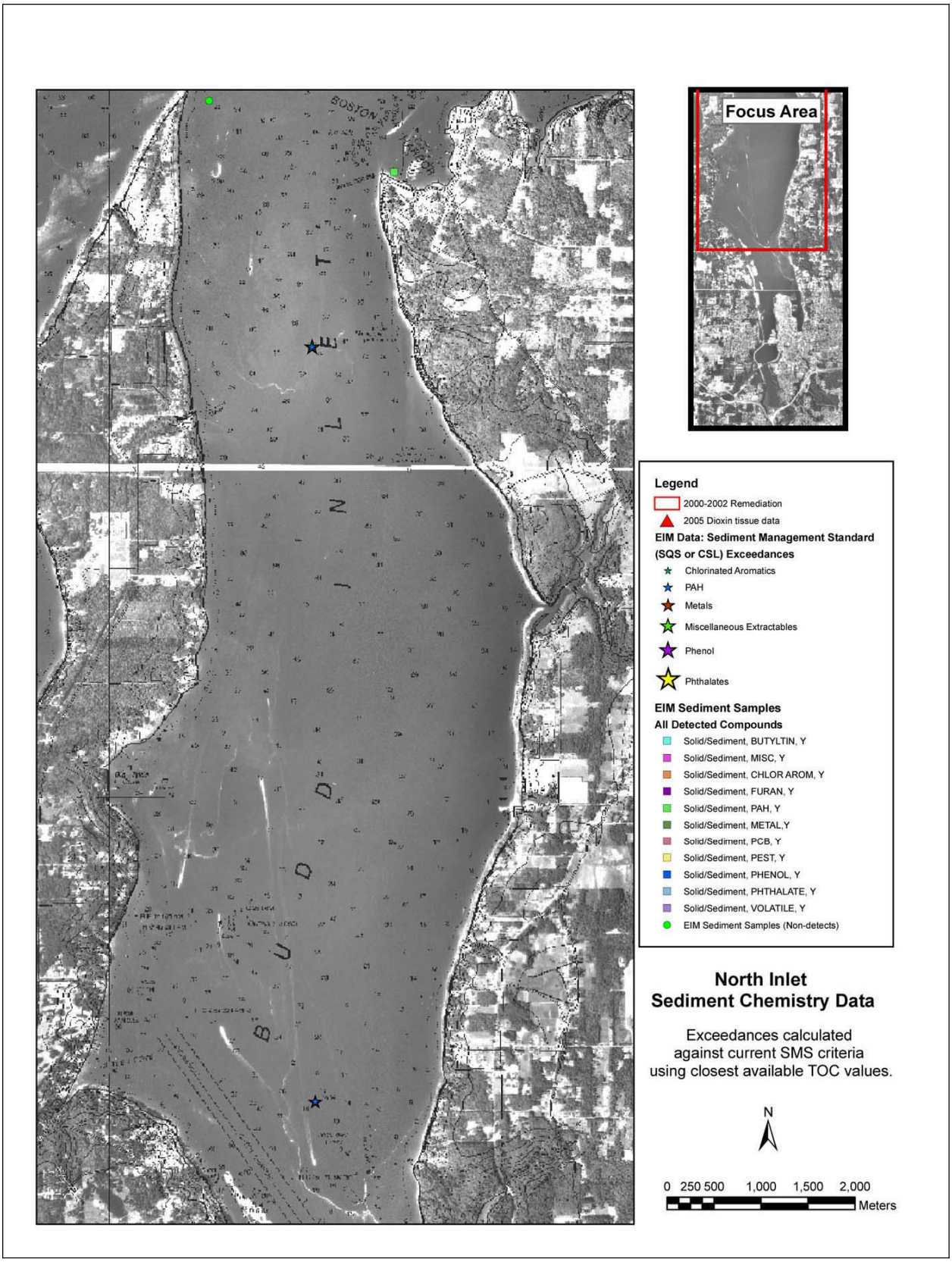

Figure 6. Sediment Chemistry Data in the North Inlet Area

4.0 Recommendations

The review of existing environmental information for Budd Inlet provides the following recommendations regarding data gaps for dioxins and furans or other chemicals of concern.

4.1 Budd Inlet (Overall)

- Strong tidal current exchanges occur in Budd Inlet, the current profile is reported to be fairly uniform with depth, and currents are directed into and out of the inlet parallel with the bottom contours (URS 1986). Therefore, a broad survey of dioxins and furans in surface sediments is recommended to ensure that the horizontal distribution of dioxins and furans is identified.

4.2 East Bay

- Sediments in the East Bay area have not been sampled for dioxins and furans and require further investigation. Offshore areas near Priest Point Park are recommended for dioxin and furan analysis, based on reports of historical dredged material disposal near the park in 1973. Tissue (bivalves) analysis is also recommended at Priest Point Park.
- PAHs, miscellaneous extractables, and phthalates have been detected in East Bay sediments in recent years at levels that exceed SMS criteria. Confirmatory gradient testing of SMS chemicals of concern near potential point sources may be warranted.

4.3 Cascade Pole

- Dioxin and furan data outside the Cascade Pole remediation site appear to be minimal. Therefore, dioxin and furan analysis is recommended for surface and subsurface sediments outside of the MBL.
- Confirmatory dioxin and furan analysis of surface and subsurface sediments is recommended directly east of the former wood treatment pond.
- Gradient testing of dioxins and furans in surface sediments is recommended near the LOTT outfall.

4.4 West Bay

- Gradient testing of dioxins and furans in surface sediments is recommended near potential point sources in West Bay (Hardel Plywood site and LOTT emergency outfall).
- Previous studies in West Bay have measured organic compounds and metals in sediments at levels that exceed SQS criteria. Confirmatory gradient testing of SMS chemicals of concern near potential point sources may be warranted.

4.5 Olympia Harbor Navigation Channel and Port of Olympia Turning Basin

- Dioxin and furan testing is recommended to the north of the navigation channel, to assess the spatial extent of dioxins and furans.
- The potential for recontamination must be minimized if maintenance dredging and/or sediment cleanup activities are conducted within the navigation channel and turning basin. Therefore, dioxin and furan testing of surface and subsurface sediments along the periphery of the channel and turning basin is recommended.

4.6 North Inlet

- Low density sampling for dioxin and furan analysis is recommended, with attention to gradient sampling near the Olympia Harbor navigation channel entrance.

5.0 References

DMMP. 2006. Supplemental Determination on the Suitability of Dredged Material Tested for Dioxin/Furans within the Olympia Harbor Federal/Port Navigation Project Evaluated Under Section 404 of the Clean Water Act for Open-Water Disposal at the Anderson/Ketron Island Non-Dispersive Site, and for Beneficial Use. September 14, 2006. Prepared by the Dredged Material Management Program. http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Final-Supp-OLY-HARBOR-DIOXIN-SDM_091206.pdf

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PSAMP. 2007. Puget Sound Ambient Monitoring Program. Data received from Sandra Aasen, Washington State Department of Ecology Coastal and Estuarine Assessment Unit. February 16, 2007.

SAIC. 2006. Olympia federal navigation channel and the Port of Olympia berthing area, Olympia, WA. Dioxin characterization data report. August 29, 2006. Prepared for the U.S. Army Corps of Engineers, Seattle District. Prepared by Science Applications International Corporation, Bothell, WA.

Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R.E. Peterson. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicological Sciences. 93(2): 223-241.

URS. 1986. Comprehensive circulation and water quality study of Budd Inlet. Southern Puget Sound water quality assessment study. Final report. Prepared for the Washington State Department of Ecology. Prepared by URS Corporation. July 31, 1986.

Appendix A
Reference Document Summaries and Locations

Document Review Form

Document Review #:
1

File Name: 01_200612_Ecology_0603041.pdf		**Date of Document:** December 2006
Report Information		
Document Title: Chemical Characterization of Stormwater Runoff from Three Puget Sound Boatyards December 2006 Publication No. 06-03-041		**Author:** Art Johnson, Steve Golding, and Randy Coots
Location of Report (URL, Source): www.ecy.wa.gov/biblio/0603041.html		**Agency:** Ecology
Dates of Study: April/May 2006	**Site Location:** Swantown Marina	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☒ PAHs ☒ Metals ☒ Mercury ☐ Pesticides ☒ PCBs ☒ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Swantown Boatworks in Olympia was included in a study of petroleum, copper and other metals, organotins, semivolatile organic compounds, and polychlorinated biphenyls (PCBs) in stormwater run-off of three boatyards around Puget Sound.

Sampling occurred during rain events in April and May of 2006. The documents mentions that a wetland is employed to treat stormwater runoff from the Swantown facility. Samples for the present study were collected at the mouth of the drain pipe that delivers runoff to the wetland. However, Swantown collects their NPDES sample downstream of the wetland at the outfall in the intertidal zone.

Sediment samples were also collected in February 2006 in the immediate vicinity of the stormwater outfall. Each sample consisted of the top 2 cm surface layer composited from three separate grabs.

The three metals that occurred in the highest concentrations in stormwater runoff – zinc, copper, and lead – were also the predominant metals in the outfall sediments. Organotins were detected in Swantown runoff, but not in sediments. PCB Aroclors 1260 and 1254 and semivolatile compounds including dibenzofuran, retene, coprostanol, benzoic acid, and PAHs were detected in sediment.

Data from this study was downloaded from EIM.

Science Applications International Corporation
18912 North Creek Parkway, Suite 101, Bothell, Washington 98011
Phone: (425) 485-5800 • Fax: (425) 487-1491

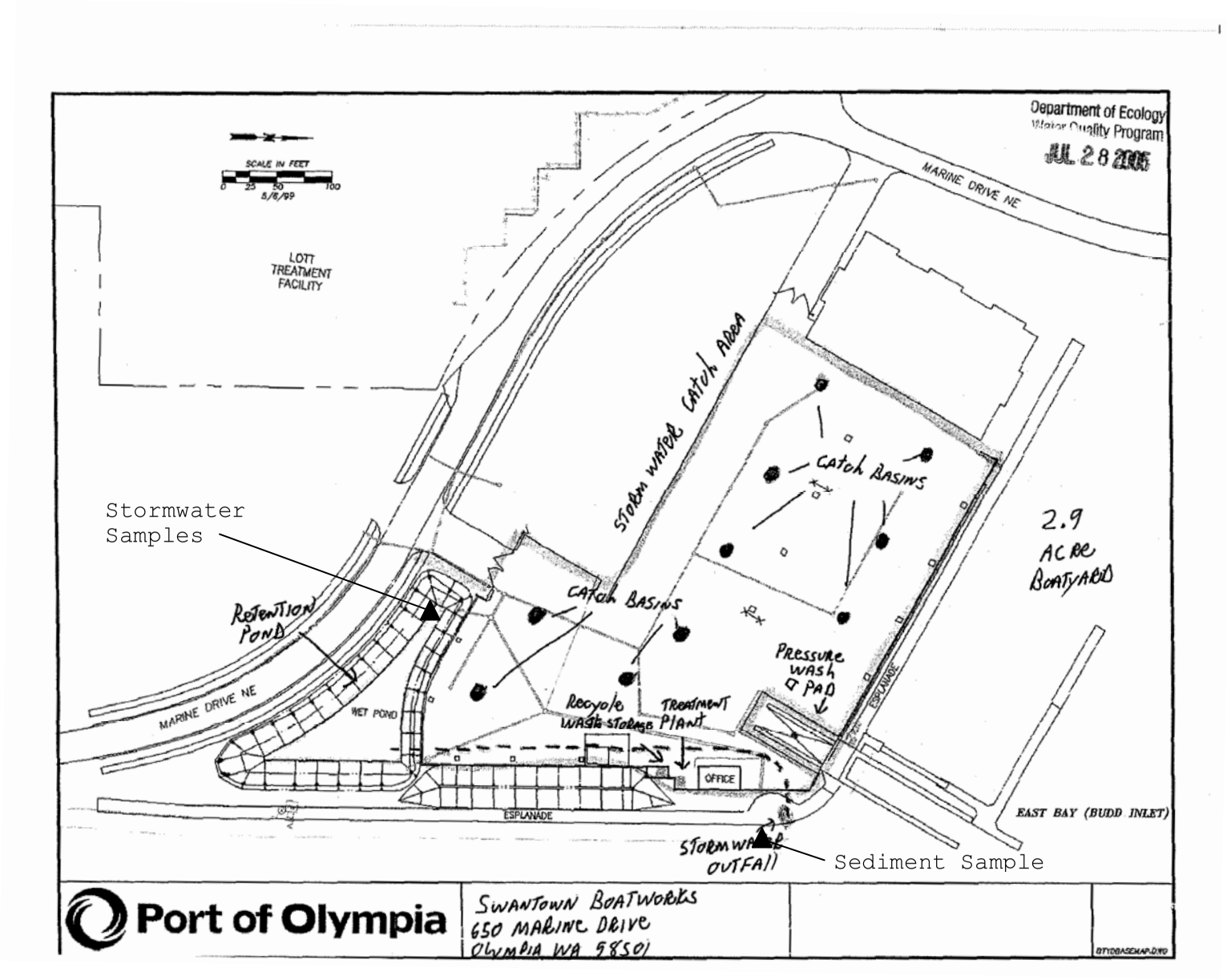

Figure 2. Swantown Boatworks Showing Location of Ecology's 2006 Stormwater Runoff and Sediment Samples.

Document Review Form

Document Review #:
2

File Name: 02_200611_Ecology_0703101draft.pdf		**Date of Document:** November 2006
Report Information		
Document Title: DRAFT- South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen Quality Assurance Project Plan		**Author:** Storrs "Skip" Albertson, Julia Bos, Karol Erickson, Greg Pelletier, Carol Maloy, and Mindy Roberts
Location of Report (URL, Source): www.ecy.wa.gov/biblio/0703101.html		**Agency:** Ecology
Dates of Study: NA	**Site Location:** South Puget Sound	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document is the study plan for determining how nitrogen from a variety of sources affects dissolved oxygen levels in South Puget Sound. Collection of water quality data will occur over a 16-month time-span (July 2006 through October 2007) from 90 Puget Sound marine sites at various depths, including 20-30 wastewater treatment plants (direct discharge to Puget Sound). The document mentions fish kills in Budd Inlet related to low D.O. problems but does not discuss sediment or tissue contamination.

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Document Review Form

Document Review #:
3

File Name: 03_200610_Port of Olympia_061023.htm		**Date of Document:** October 2006
Report Information		
Document Title: Port of Olympia Commission: Minutes of Regular Meeting - October 23, 2006		**Author:**
Location of Report (URL, Source):		**Agency:** Port of Olympia
Dates of Study: NA	**Site Location:** Port of Olympia	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Ms. Andrea Fontenot, Public Works Director, provided the Commission with a PowerPoint presentation on the Port of Olympia dredging project. She reviewed the Maintenance Dredge Project and the maritime history of the marine terminal. Ms. Fontenot outlined the project and the sediment management program that included testing in 1999 and 2006 and the results of the testing. Adressing the dioxin issue, she commented that until further testing is done, the source of the dioxin is unknown, however, there are three known potential sources: urban storm water, historical land uses, and airborne particles. Concerns were raised by attendees regarding health risks, dispersal of contaminanats during dredging, and how long the contamination issue has been known. Jay Manning, Director of Ecology responded that issues have been known around the Cascade Pole site since the late 70's and early 80's, but recent findings are the first indication of contamination outside that area.

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Document Review Form

Document Review #:
4

File Name: Electronic file not available		**Date of Document:** 9/28/2006
Report Information		
Document Title: Ecology Review Draft Groundwater Monitoring Report - June 2005 and March 2006		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study: 6/2005, 3/2006	**Site Location:**	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The document covers the groundwater monitoring program objectives, procedures, and results. No dioxin analysis was performed. cPAH exceedances within the groundwater containment area were documented with MW-01S having the most exceedances including PCP and TPH.

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Document Review Form

Document Review #:
5

File Name: 05_200609_Ecology_2006-186.html	**Date of Document:** September 14, 2006

Report Information

Document Title: Joint news release from the Dredged Material Management Program, consisting of the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and the Washington departments of Ecology and Natural Resources		**Author:**
Location of Report (URL, Source): http://www.ecy.wa.gov/news/2006news/2006-186.html		**Agency:** DMMP
Dates of Study: NA	**Site Location:**	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The news release describes DMMP and the findings of the suitability determination for disposal of material from proposed dredging in Port of Olympia navigation channel. The DMMP agencies determined that dioxin levels in more than half the material to be dredged are high enough that they need to be disposed on land or in a confined, aquatic disposal site.

The news release documented a health advisory issued by Thurston County Health Department recommending that shellfish harvested from the south end of Budd Inlet near Swantown Marina may not be eaten due to chemical contamination (including dioxin).

The last maintenance dredging in Budd Inlet occurred in the 1970s and disposal of that material was not mentioned. A plan is in the works to accomplish both priority dredging for navigation and removal of significant quantities of dioxins from the marine environment that may be subject to erosion/re-suspension as vessels transit the channel and berthing areas.

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Document Review Form

Document Review #: 6

File Name: 06_200607_Ecology_0603026.pdf		**Date of Document:** July 2006
Report Information		
Document Title: South Puget Sound Verification of 303(d) Listings for Chemical Contaminants in Fish and Shellfish		**Author:** Era-Miller, B.
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0603026.pdf		**Agency:** Ecology
Dates of Study: 11/10/2005	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☒ Dioxins/furans ☒ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☒ Other : Pentachlorophenol	

Summary of Findings

Three composite samples of bay mussels (Mytilus trossulus) were collected from the Cascade Pole intertidal cleanup/excavation site and analyzed for 303(d)-listed contaminants: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(k)fluoranthene. At the request of Ecology's Toxics Cleanup Program, additional PAHs, pentachlorophenol (PCP), and dioxin/furans were also analyzed.

PCB congeners detected in Sole.

PAHs detected in shellfish, with values exceeding National Toxics Rule (NTR) human health criteria for edible fish tissue.

The majority of the 17 dioxin/furans congeners were detected; however, NTR human health criteria have only been developed for the 2,3,7,8-TCDD congener (0.07 ng/Kg, ppt). The NTR criterion was exceeded for only one of the three samples (3-Close).

Four currently 303(d)-listed PAH chemicals – benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene – were found to exceed the NTR criterion of 0.93 ug/Kg ww. Two others – benzo(a)pyrene and indeno(1,2,3-cd)pyrene – also exceeded NTR criteria. All six of these chemicals should be included in Category 5 of the 303(d) List.

Although not previously analyzed for, dioxin congener 2,3,7,8-TCDD was found to exceed the NTR criterion of 0.07 ng/Kg, parts per trillion. TEQ values for dioxins and furans were also found to exceed the NTR criterion for 2,3,7,8-TCDD.

EIM study ID: BERA0003

EIM data download: Y

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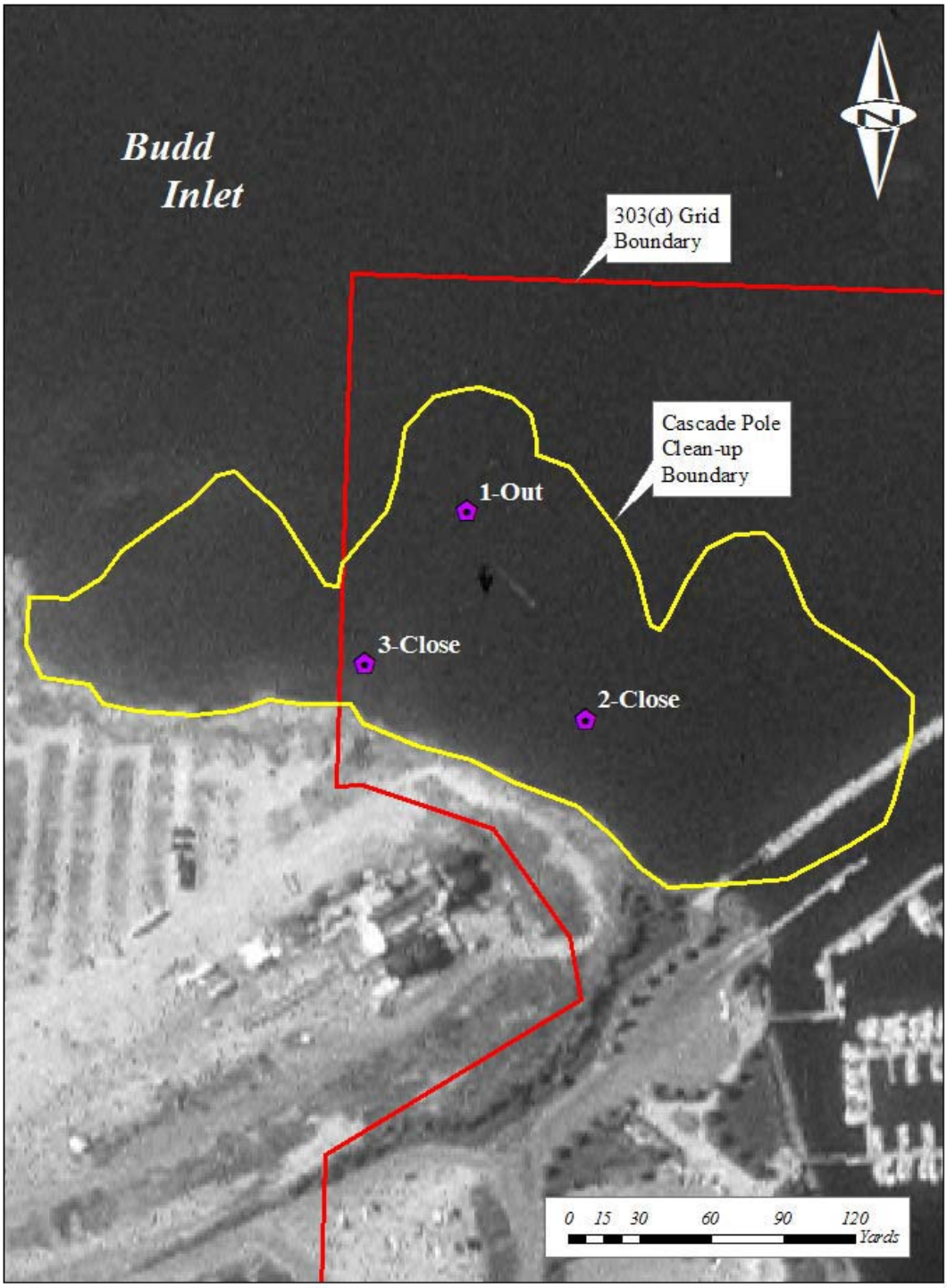

Figure 3. Mussel Sampling Locations at the Cascade Pole Clean-up Site.

Document Review Form

Document Review #: 7

File Name: No electronic file available.		**Date of Document:** 12/18/2004
Report Information		
Document Title: Report: Post Construction Sediment Compliance Monitoring - Cascade Pole Site, Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study: 4/9/02-4/12/02	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☒ Dioxins/furans ☒ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

To verify clean-up action levels were achieved and to monitor progress of natural recovery, sediment compliance monitoring was performed following removal and backfilling of the area within the multiple benefits line (MBL).

A total of 31 subsurface samples (including 1 duplicate) from 15 locations and 22 surface samples (including 2 duplicates) from 20 locations. CP 1- CP15 samples were collected within the MBL.

-from the dredged interface to 1 foot below

-6 inches from the interior of the backfill (archived)

-backfill surface from 0-10 cm in bioactive layer.

Samples collected outside the MBL (CP16-CP20) were at the surface only.

Analysis of confirmational samples (the archived backfill interior samples) was required due to detections at CP6 (D) (acenaphthene), CP14 (cPAH), CP15 (fluoranthene, pyrene, benzo(a)anthracene, dioxin).

The report states that surface samples beyond the MBL were below clean-up levels. The report also concluded that although COC's were present above cleanup levels at 3 locations at the dredge interface, the overlying backfill was below clean-up levels. Additional monitoring core samples were recommended for spring 2003 (the report for that sampling event has not yet been located. Neither dataset appears in EIM but copies were made of the sample results from this document).

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Document Review #:
8

File Name: 08_200406_Ecology_Cascade_Pole_SEPA_DNS.pdf		**Date of Document:** June 1, 2004
Report Information		
Document Title: Determination of Non-Significance		**Author:** Rebecca Lawson, P.E.
Location of Report (URL, Source): http://www.ecy.wa.gov/programs/tcp/sites/cascade_pole/Cascade_Pole_SEPA_DNS.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Application from Port for SEPA DNS for capping. The document includes capping/paving descriptions of upland site area and plan view map.

Section 7a states that the site polynuclear aromatic hydrocarbons, chlorinated phenols, petroleum hydrocarbons, dioxins, and furans in soil.

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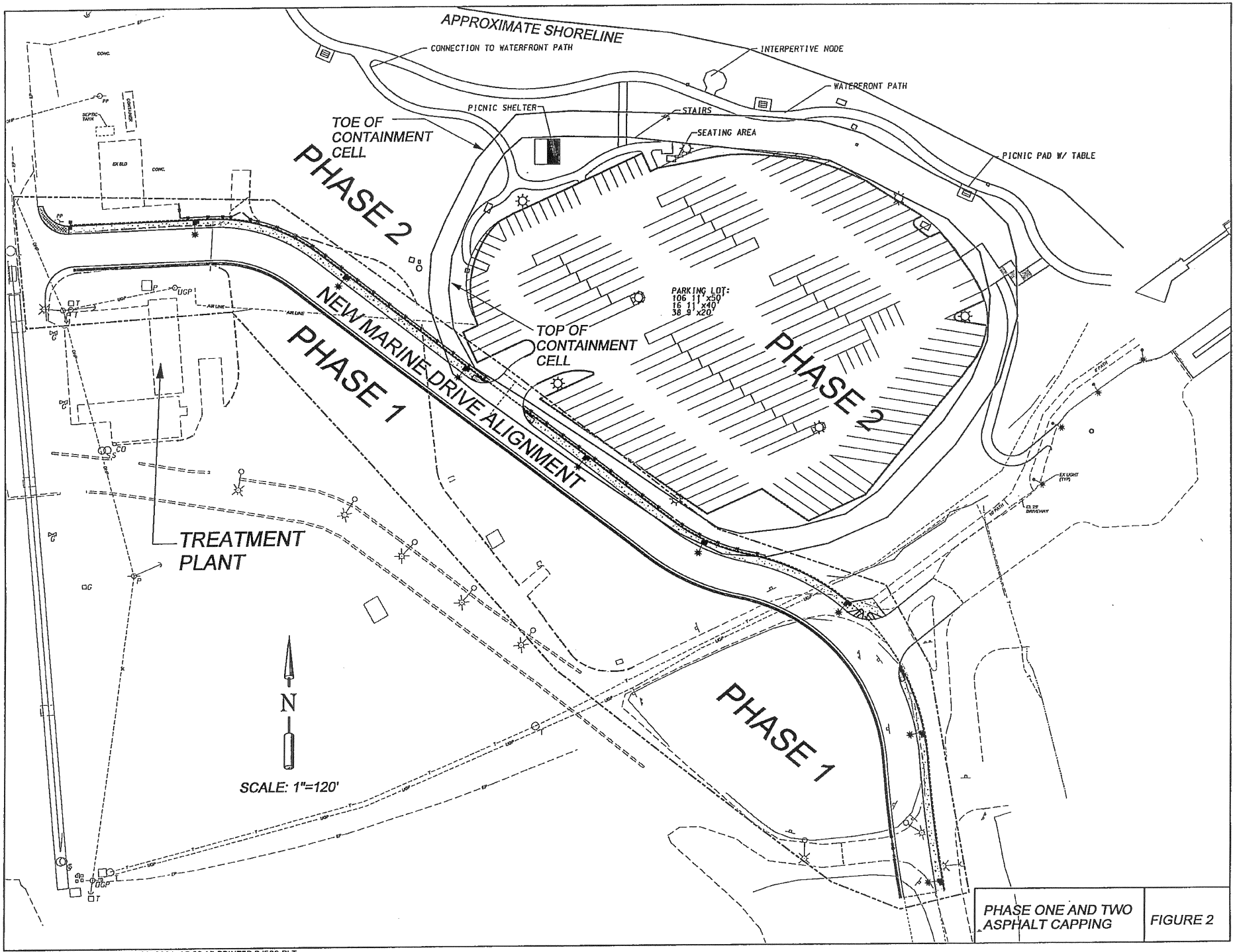

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Document Review Form

Document Review #:
9

File Name: 09_200406_Ecology_0409061.pdf		Date of Document: June 2004
Report Information		
Document Title: Cascade Pole Olympia		**Author:** Miriam Duerr
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0409061.pdf		**Agency:** Ecology
Dates of Study: June 2004	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Fact sheet summarizes the amendment of a Model Toxics Control Site Background Act (Chapter 70.105D RCW) order requiring further cleanup and long-term monitoring be conducted at the Cascade Pole, Olympia site, including:

-pave the remainder of the site in two phases;

-sample the sediment cleanup area in Budd Inlet every five years;

-sample groundwater every six months to verify the effectiveness of the cleanup;

-design and construct a new groundwater treatment system.

This amends the April 2000 agreed order for interim action at the site. In addition, Ecology is issuing a State Environmental Poiicy Act (SEPA, Chapter 197-1 1 WAC) determination of nonsignificance (DNS) for the paving proposed in the agreed order amendment.

The document also summarizes the site history, stating that previous upland studies have identified PAHs, PCP, volatile hydrocarbons, and dioxin at elevated concetrations in soil, groundwater, surface water, and intertidal sediments and tissue but does not cite studies. This document also states that 35,000 cubic yards of sediment were removed with upland disposal (document 29 states that 42,000 cubic yards were removed).

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Document Review Form

Document Review #:
10

File Name: Electronic file not available		**Date of Document:** 3/12/2004
Report Information		
Document Title: Remedial Action Completion Report - Cascade Pole Sediment Remediation Project, Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Summary of Findings		
The document describes sediment removal and containment but there was no mention of post-remedial sampling. Post construction sediment monitoring is covered in document 7.		

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Document Review Form

Document Review #: 11

File Name: 11_200304_Ecology_0303016.pdf		**Date of Document:** April 2003
Report Information		
Document Title: Verification of 1998 303(d) PCB Listing, Inner Budd Inlet		**Author:** Golding, S.
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0303016.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Budd Inlet, East Bay	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☒ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Inner Budd Inlet was placed on the 1998 303(d) list for polychlorinated biphenyls (PCBs) based on a single composite sample of mussels collected from a culvert at the mouth of Moxlie Creek where it enters East Bay. That sample had a total PCB concentration of 21 µg/Kg wet weight (ww). (EIM Study ID: WSPMP95M; EIM data download: Y).

This document summarizes more intensive sampling of mussels conducted on September 6, 2002, to determine if the Inner Budd Inlet PCB listing continues to be warranted. Samples of blue mussel (Mytilus trossulus) from the sites in East Bay were found to have PCB concentrations ranging from 7.0 to 9.6 µg/Kg ww. All of these concentrations exceed the current 303(d) listing criterion of 5.3 µg/Kg ww. The PCB mixture found was in a form most closely resembling PCB 1254. A fourth site at Priest Point Park had an estimated PCB 1254 concentration of 3.0 µg/Kg ww.

EIM study ID: SGOL004

EIM data download: Y

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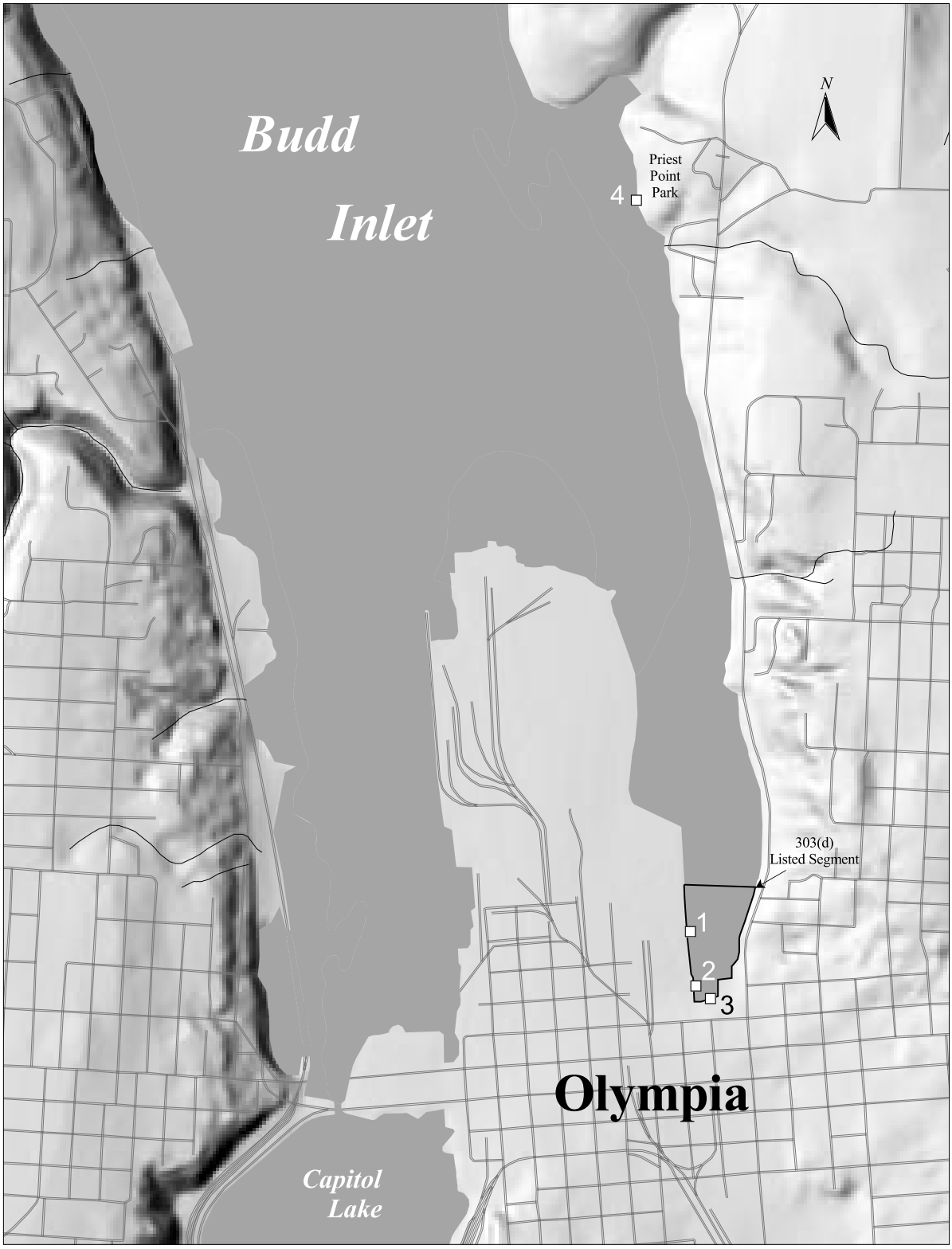

□ – mussel monitoring site

Figure 1. Budd Inlet Mussel Sampling Locations.

Document Review Form

Document Review #:
12

File Name: 12_200303_STATE OF WASHINGTON_pchb 02-198 summary judgment.htm		**Date of Document:** March 24, 2003
Report Information		
Document Title: POLLUTION CONTROL HEARINGS BOARD: JERRY LEE DIERKER,Appellant, v. STATE OF WASHINGTON,DEPARTMENT OF ECOLOGY; and PORT OF OLYMPIA;		**Author:**
Location of Report (URL, Source): http://www.eho.wa.gov/searchdocuments/2003%20Archive/pchb%2002-198%20summary%20judgment.htm		**Agency:** POLLUTION CONTROL HEARINGS BOARD
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

An appeal filed with the Pollution Control Hearings Board ("Board"), by Jerry Lee Dierker contesting the Department of Ecology's ("Ecology") issuance of National Pollutant Discharge Elimination System ("NPDES") Permit No. WA0040533 to the Port of Olympia ("Port") for the discharge of treated groundwater to Budd Inlet, in Thurston County, Washington. The document summarizes legal actions surrounding NPDES permitting conditions. Mr. Dierker challenges the compliance of Ecology and the Port with SEPA and NEPA, arguing that the new permit must violate the water quality standards because the containment cell contains more contaminants than the previous dredging operation. He also challenges two determinations of non-significance ("DNS") issued by Ecology, in regard to the cleanup project. One, in 2000, addressed the containment operation. The one in 2001 addressed the dredging operation. Ecology asserted the NPDES was adequate to ensure the protection of the water quality of Budd Inlet and that the DNS projects would likely improve the water quality, over that which existed prior to the containment project. The appeal was dismissed.

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Document Review Form

Document Review #:
13

File Name: 13_200210_Ecology_0203085.pdf		**Date of Document:** October 2002
Report Information		
Document Title: Quality Assurance Project Plan; Verification of 1998 303(d) Listing for PCBs in Budd Inlet (Inner)		**Author:** Steven Golding
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0203085.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Budd Inlet	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document describes the study design, data objectives, field and laboratory procedures, and data assessment to provide more intensive sampling to determine if the 303d PCB listing for shellfish from 1998 (based on one grab composite sample of shellfish tissue) is still warranted. The results of this study can be found in Verification of 1998 303(d) PCB Listing, Inner Budd Inlet (document 11).

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Document Review Form

Document Review #: 14

File Name: 14_200207_Ecology_0203033.pdf		**Date of Document:** July 2002
Report Information		
Document Title: Sediment Quality in Puget Sound: Year 3, Southern Puget Sound		**Author:** Long, E., M. Dutch, S. Aasen, K. Welch et al.
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0203033.pdf		**Agency:** Ecology
Dates of Study: 1999	**Site Location:** South Puget Sound	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☒ PAHs ☒ Metals ☒ Mercury ☒ Pesticides ☒ PCBs ☒ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

As a component of a three-year cooperative effort of the Washington State Department of Ecology and the National Oceanic and Atmospheric Administration, surficial sediment samples from 100 locations in southern Puget Sound were collected in 1999 to determine their relative quality based on measures of toxicity, chemical contamination, and benthic infaunal assemblage structure. Findings for Budd Inlet and Port of Olympia include:

-Organic chemicals exceeded SQS and CSL values

-Two samples from Port of Olympia were the most toxic among South Puget Sound samples in the urchin fertilization toxicity tests. Fertilization success in these two samples was 0% in 100% porewater, 0% to 0.4% in 50% porewater, and 0.2% to 3.8% in 25% porewater. The high degree of toxicity observed in Port of Olympia diminished rapidly seaward into Budd Inlet, where none of the samples were toxic.

-Concentrations of benzoic acid, benzyl alcohol, and/or phenol exceeded SQS and CSL levels in the other samples from Budd Inlet and the Port of Olympia.

-The two samples from Port of Olympia had benthic results scoring 0 in benthic evaluations as they had no living organisms in them whatsoever.

-The un-ionized ammonia concentration of 398.6 ug/L was recorded in sample 242 (Port of Olympia) and it was very toxic in all three porewater concentrations.

-The fertilization toxicity of the samples was most severe in two samples (242 and 243 from Port of Olympia).

-Values for Port of Olympia was among the most severe response in the Microtox and Human Reporter Gene System (Cytochrome P450) Response tests primarily driven by the presence of PAH chemicals and minimally attributable to the chlorinated chemicals.

-Phenol exceeded SQS and CSL values in samples from the Port of Olympia.

-Toxicity tests performed for urchin fertilization, microbial bioluminescence, and cytochrome HRGS enzyme induction indicated correspondence with complex mixtures of potentially toxic chemicals in the sediments. Often, the results of the Microtox and cytochrome P450 HRGS tests showed the strongest correlations with chemical concentrations. Whereas the urchin fertilization tests showed correlations with chemical concentrations in northern and central Puget Sound, they failed to indicate such patterns in southern Puget Sound. .

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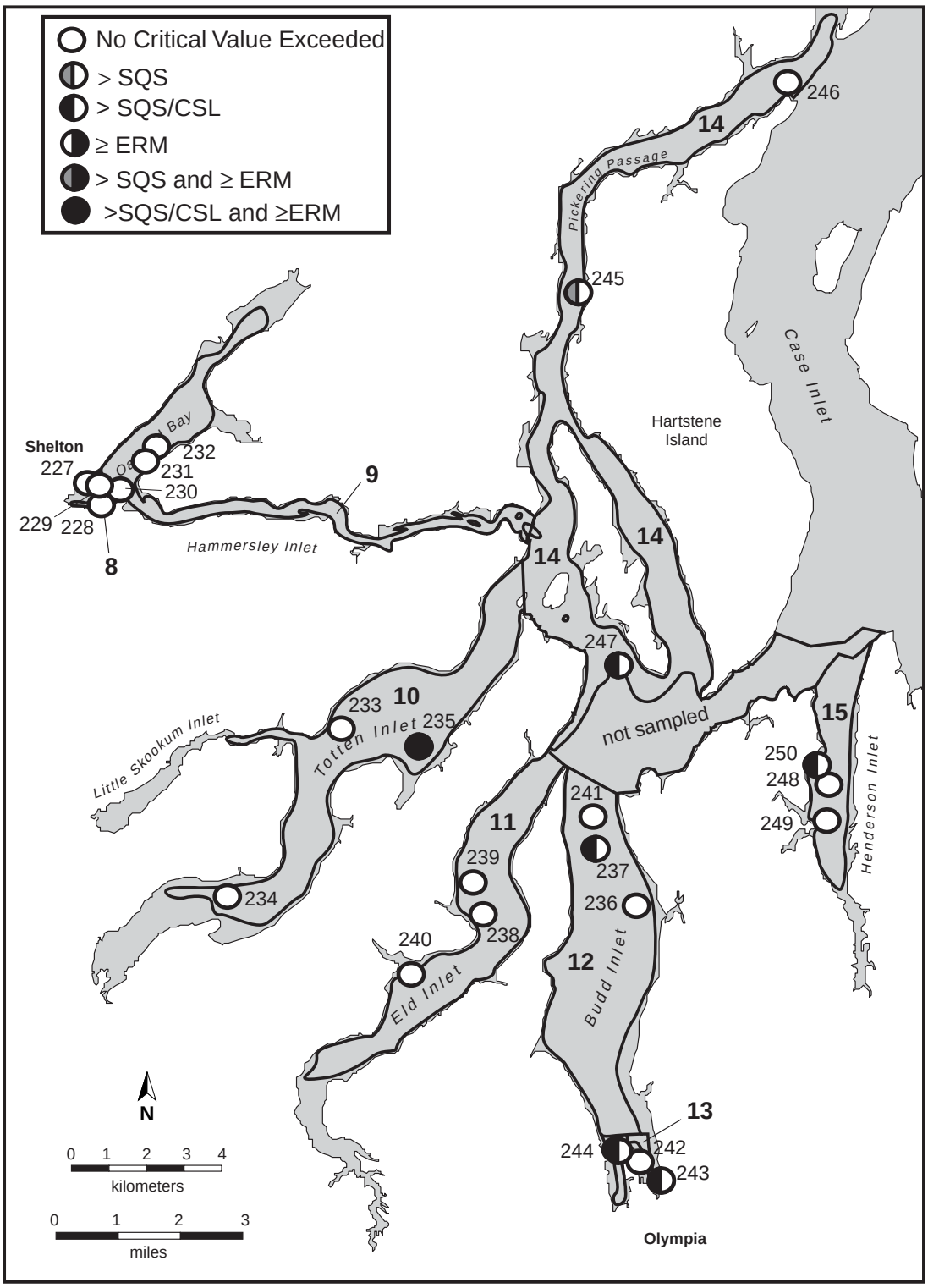

Figure 17. Sampling stations in Pickering Passage through Henderson Inlet (8 through 15) with sediment chemical concentrations exceeding numerical guidelines and Washington State criteria. (Strata numbers are shown in bold. Stations are identified as sample number).

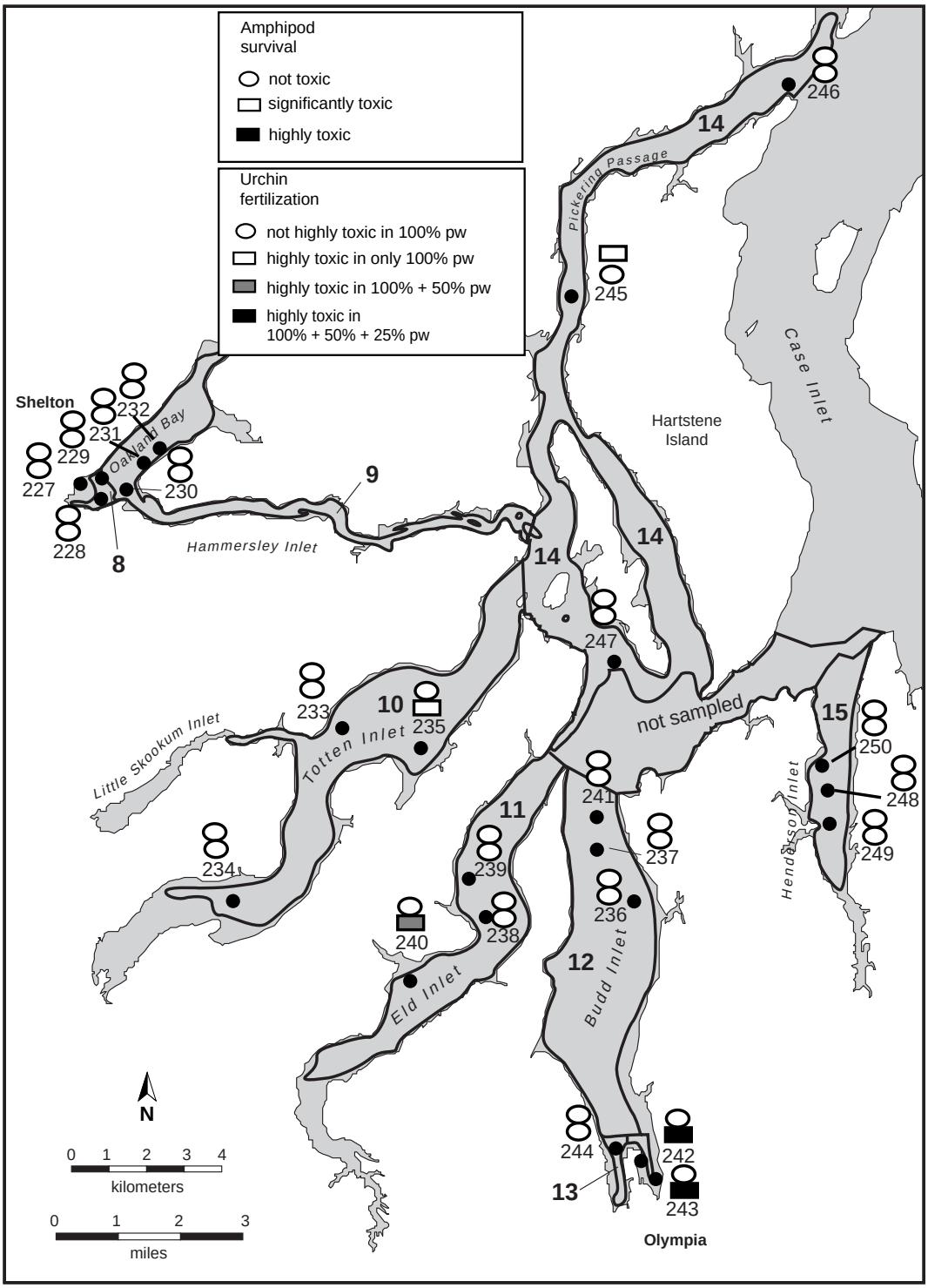

Figure 5. Summary of 1999 amphipod survival tests (top symbols) and sea urchin fertilization tests (in three porewater concentrations, bottom symbols) for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

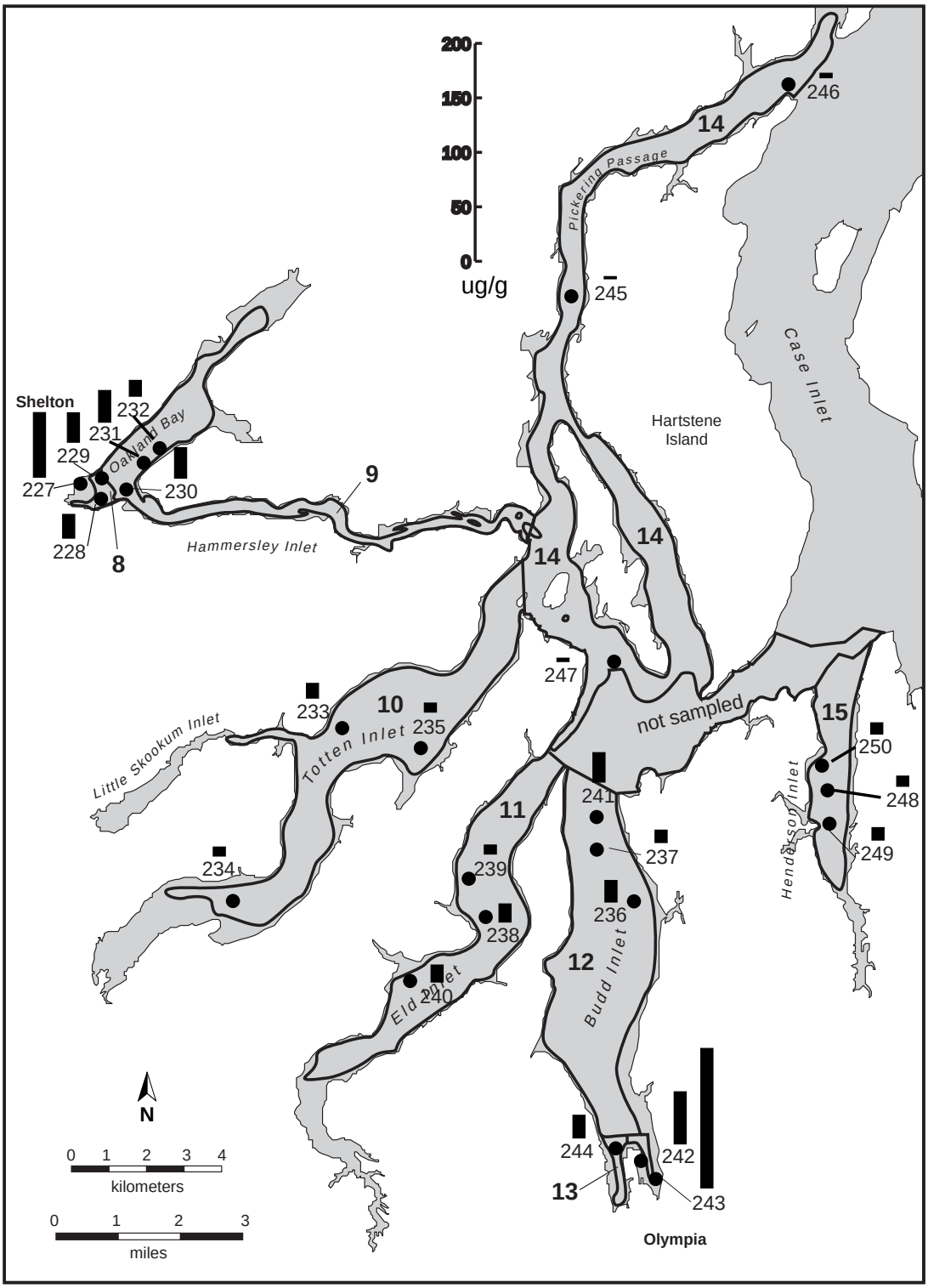

Figure 13. Results of 1999 cytochrome P450 HRGS assays (as B[a]P equivalents (µg /g)) for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

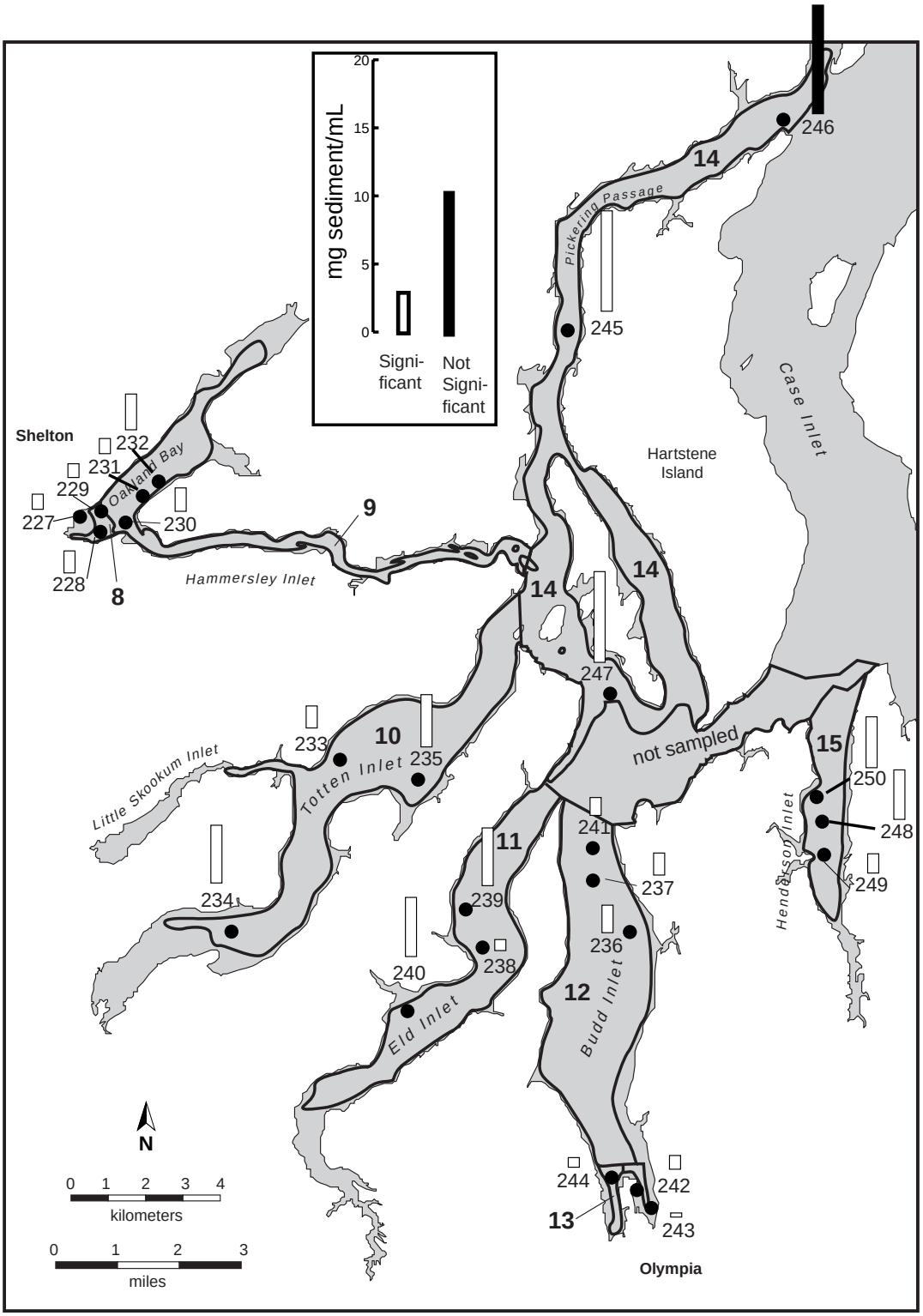

Figure 9. Results of 1999 Microtox™ bioluminescence tests for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

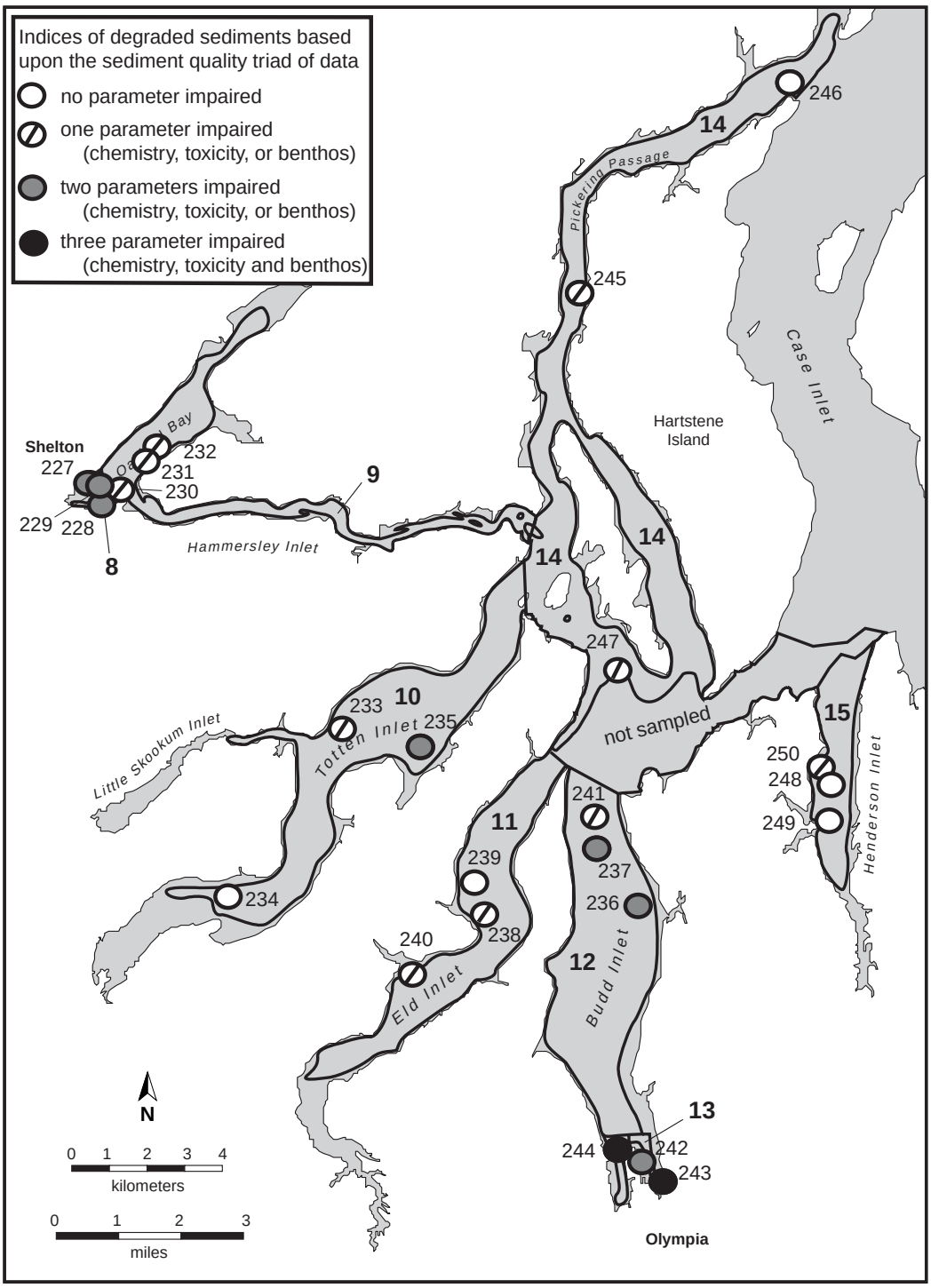

Figure 28. Classification of sediment quality at southern Puget Sound stations sampled during 1999 PSAMP/NOAA survey according to the Sediment Quality Triad of measurements – Pickering Passage through Henderson Inlet (strata 8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

Document Review Form

Document Review #:
15

File Name: 15_200310_Ecology_0303049.pdf		**Date of Document:** October 2003
Report Information		
Document Title: Chemical Contamination, Acute Toxicity in Laboratory Tests, and Benthic Impacts in Sediments of Puget Sound. A summary of results of the joint 1997-1999 Ecology/NOAA survey		**Author:** Edward R. Long, Margaret Dutch, Sandra Aasen, and Kathy Welch (Ecology); M. Jawed Hameedi (NOAA)
Location of Report (URL, Source): http://www.ecy.wa.gov/biblio/0303049.html		**Agency:** Ecology/NOAA
Dates of Study: 1997-1999	**Site Location:** Puget Sound	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document summarizes a three-year cooperative study by Ecology and NOAA. Year 3 pertains to South Puget Sound and includes Budd Inlet. Results and findings from that portion of the investigation are covered in detail in the "Sediment Quality in Puget Sound: Year 3, Southern Puget Sound." Refer to Document 14 document review form.

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Document Review Form

Document Review #:
16

File Name: 16_HardelsuesOlympiacase.pdf		**Date of Document:** 4/23/2003
Report Information		
Document Title: Hardel Mutual Plywood v. City of Olympia		**Author:**
Location of Report (URL, Source): http://www.morelaw.com/Washington/cases/		**Agency:** Superior Court, Thurston County, Washington
Dates of Study:	**Site Location:** Hardel Plywood	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The only document found online regarding the fire at Hardel Plywood. Document states that the mill burned the morning of Sept. 1, 1996 and that it was one of the largest fires in the history of Olympia. No information on chemicals or runoff.

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Document Review Form

Document Review #: 17

File Name: 17_199901_Ecology_99305.pdf		**Date of Document:** February 1999
Report Information		
Document Title: Lower Budd Inlet Sediment Characterization Study: Midwest Site Evaluation and Chemical Screening of Selected Point Sources		**Author:** Norton, Dale
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/99305.pdf		**Agency:** Ecology
Dates of Study: June 1998	**Site Location:** Cascade Pole	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☒ PAHs ☒ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☒ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other : Pentachlorophenol	

Summary of Findings

Sediments were collected from the Midwest Site in lower Budd Inlet was performed in June 9-10, 1998 from 14 locations for chemical and biological testing, to determine if this area should still be listed on the Washington State Department of Ecology Contaminated Sediment Site List. The original basis for listing the Midwest Site on the CSSL was toxicity in the larval echinoderm test (McMillan, 1992).

Chemical screening (metals and organics) was conducted near several potential sources including:

- 6 sites in the midwest portion of the turning basin to evaluate listing as a contaminated site.

- 2 sites near the former Hardel Plywood site drains to evaluate suspected contamination adjacent to historical drain.

- 1 site near Fiddlehead marina to evaluate contamination levels near outfall.

- 2 sites near West Bay Marina to screen for impacts from boatyard run-off.

- 1 site near Berth B Log Terminal to evaluate sediments adjacent to port dock.

- 1 site near Moxlie Creek in the south end of the East Bay to screen for discharge impacts.

-Based on the potential for sources, butyltin levels were only measured at the two marina locations (West Bay Marina and near the Fiddlehead Outfall

Findings were:

-Metal concentrations at all stations in Budd Inlet were low and similar to the reference site.

-Concentrations of most organic compounds were low.

-SMS exceedances occurred at Fiddlehead Outfall (butyl benzyl phthalate and bis(2-ethylhexyl) phthalate) and at the Moxlie Creek outlet (phenanthrene, fluoranthene, Butylbenzyl Phthalate, and bis(2-ethylhexyl)phthalate).

-The only significant concentrations of LPAH and HPAH were at stations located near the Fiddlehead Outfall and in East Bay at the outlet of Moxlie Creek.

-The distribution of LPAH vs HPAH indicates that the sediments sampled have undergone some weathering, which implies that historical PAH sources are primarily responsible for the PAH contamination observed. Peak concentrations of two of the three compounds (coprostanol and bis(2-ethyl hexy1)phthalate) were present near the Fiddlehead Outfall. The Fiddlehead Outfall was used as a sewage bypass for the LOTT treatment plant during high flow events. Discharge was reduced in 1997 but as of this report, stormwater was still discharged through the outfall.

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-The highest butyltin levels were present inside the West Bay Marina. Compared to concentrations at the reference station, tributyltin levels inside the West Bay Marina were elevated by over two orders of magnitude.

-No acute (amphipod) or chronic (juvenile polychaete) toxicity was observed in sediments from the Midwest Site. Based on the bioassay results, sediments from the site should not have adverse impacts on biological communities.

-No chemicals were detected above the SMS in bottom sediments from the Midwest Site in the turning basin.

The report concludes that:

-Most of the chemical contamination problems seem to be associated with specific discharges.

-Tributvltin concentrations inside the West Bay Marina and near the Fiddlehead exceeded the screening level which requires biological testing to be performed.

-For the Midwest Site, no chemicals were measured above the SMS.

-Toxicity evaluation using the amphipod and juvenile polychaete bioassays indicated that sediments from the Midwest Site should not have adverse effects on benthic communities. Based on the findings, it is recommended that the Midwest Site be re-scored by the Sediment Management Unit and be considered for removal from the Contaminated Sediment Site List. Results confirm that contaminants analyzed for are relatively low in sediments from the lower Budd Inlet study area. Most of the problems detected appear to be associated with specific sources.

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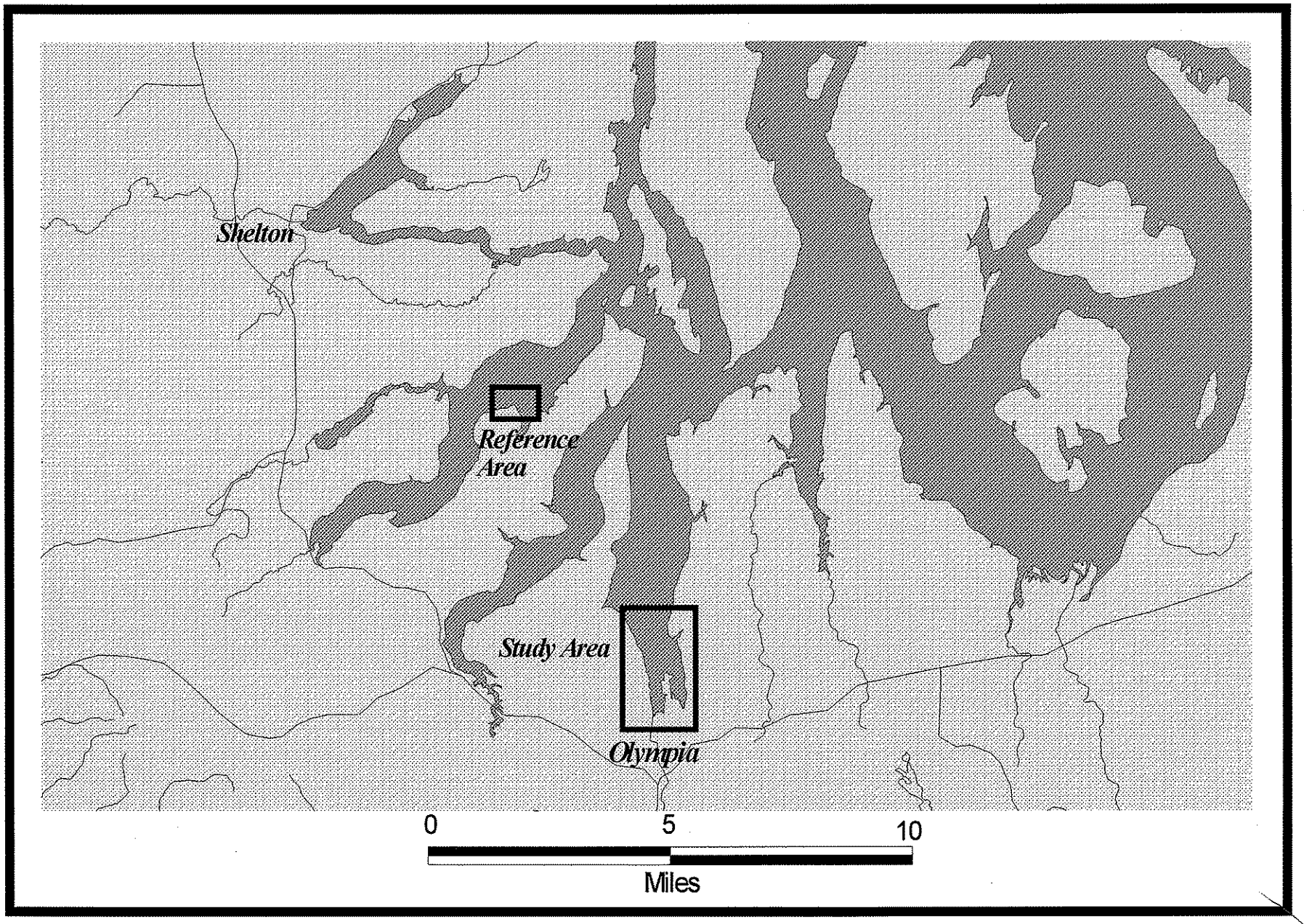

Figure 1: Budd Inlet Sediment Characterization Project, Study Area.

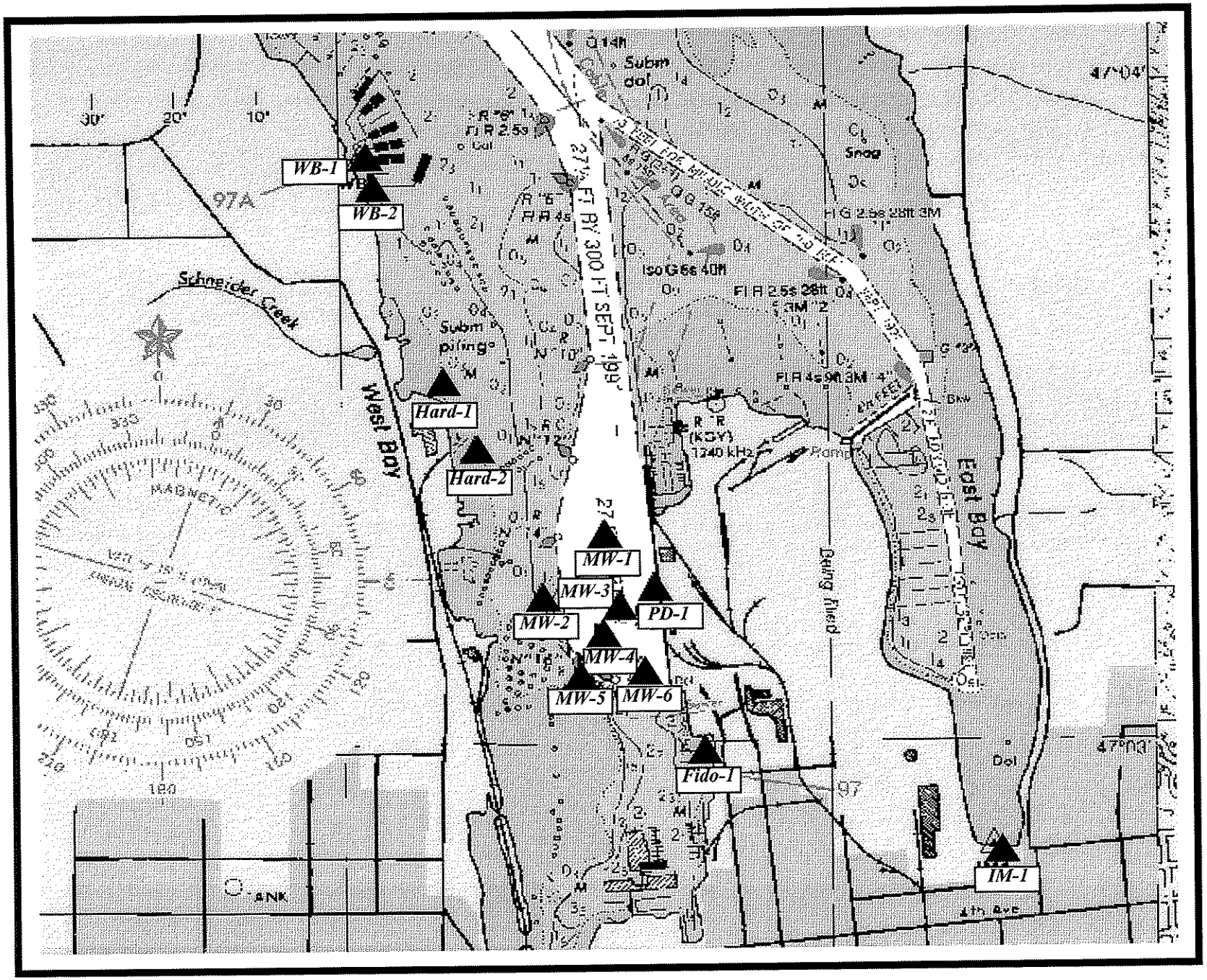

Figure 2: Budd Inlet Station Locations

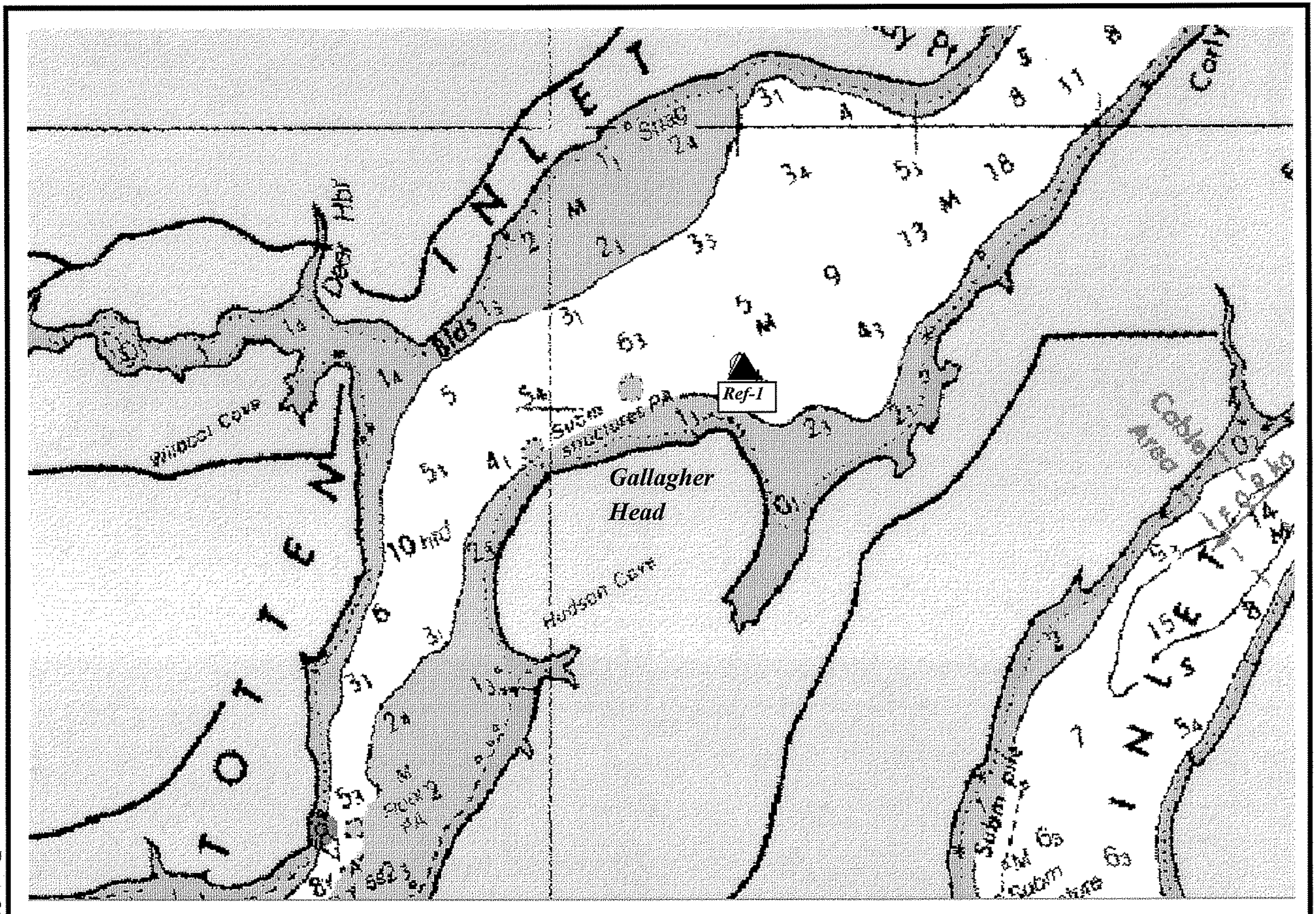

Figure 2 (cont.): Reference Station Location in Totten Inlet

Document Review Form

Document Review #: 18

File Name: 18_cascadeDOH_thurston_12-22-00.pdf		**Date of Document:** December 22, 2000
Report Information		
Document Title: Health Consultation: Cascade Pole and Lumber Company-Thurston County, Washington		**Author:** Paul Marchant
Location of Report (URL, Source):		**Agency:** Washington State Department of Health
Dates of Study: Uses existing data	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☒ Dioxins/furans ☒ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☒ Dioxins/furans ☒ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Existing data from the Cascade Pole Sediments Operable Unit Risk Assessment, Remedial Investigation and Feasibility Study reports, Draft Cleanup Action Plan, and other supporting site documents were used for this document (references attached). The document presents a summary of investigations, actions, and findings at the site. It states that environmental investigations conducted at the site since the mid-1980's have documented the presence of contaminants in both of these areas, including soil, groundwater, marine sediments, marine water, seeps, and clam tissue. Contaminants detected in the Sediments OU include dioxins, furans, carcinogenic polynuclear aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), other semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and metals. Contaminants detected in the Uplands portion of the site include PAHs, PCP, dioxins, and furans in the soil, and PAHs, PCP, metals, and VOCs in the shallow aquifer. Many of these contaminants are associated with historical wood-treating activities at the site.

A baseline Risk Assessment (RA) was conducted shortly after the RI to evaluate potential human health risks. Clam tissue sampling results were used in estimating potential health risk and the RA concluded that the majority of risk in the Sediments OU was due to carcinogenic PAHs in sediments and clam tissue, chlorinated dibenzo-p-dioxins and dibenzofurans in sediment, water, and clam tissue; and PCP in sediments and seeps.

The document refers to Landau reports that describe a pilot dredging project, a hydrogeologic site investigation, and a spoils pile evaluation conducted since 1997.

Map figures are included in the document but do not display.

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Document Review Form

Document Review #:
19

File Name: 19_washingtonportsarticle010507.pdf		Date of Document: January 2007
Report Information		
Document Title: Two Washington Ports articles from the Olympian		**Author:** John Dodge
Location of Report (URL, Source): http://www.washingtonports.org/member_resources/newsroundup/january2007/010507.asp		**Agency:** The Olympian
Dates of Study: NA	**Site Location:**	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Dioxin was found within the boundaries of a proposed project to dredge the shipping channel and marine terminal berths at the Port of Olympia. The two highest concentrations of dioxin found in the first 4 feet of sediment slated for dredging were next to port shipping berths: 52.3 parts per trillion and 52.7 ppt. Dioxin was found in numerous parts of the inlet. The highest concentrations are near port and Olympia stormwater discharge pipes. More than 50 percent of the 458,000 cubic yards of sediment slated for dredging was too contaminated to dispose of at an open water site between Ketron and Anderson islands. The articles state that a study, set to begin soon, is aimed at better determining the source and extent of dioxin contamination in lower Budd Inlet. It comes after last year's discovery of high levels of the toxic chemical in marine sediments in the inlet. Rebecca Lawson, Ecology, stated that possible sources include particles in auto exhaust reaching the water in stormwater runoff and pollution from industries, including wood fuel burners from mills that once lined the Olympia waterfront. She also said Capitol Lake sediments need to be examined for dioxin before any decision to take out the Fifth Avenue Dam. The articles mentioned proposed dredging costs and criticism over economic responsibility.

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Document Review Form

Document Review #:
20

File Name: Ecology Archive		**Date of Document:** 10/13/2000
Report Information		
Document Title: Draft Engineering Design Report - Sediment Cleanup Action, Cascade Pole Site, Olympia, Washington.		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Landau
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The document provides a site history of operations and description of previous investigations. A summary of 1993 RI findings by Landau included a description of lateral and vertical distribution of creosote-related contamination. Contamination in the sediment operable unit extends laterally from the former wood treatment log pond to the east and, to a lesser extent, to the north and northeast. Vertical sediment contamination was found highest in the 10-55 cm and 55-100 cm depth intervals. Contamination was found to be limited by an underlying silt and clay layer.

PCP-related sediment contamination was found in the shoreline northwest of the wood treatment area and appeared to be from runoff, former seeps, or a stormwater pipeline along the northern shore.

Standing water over sediment and water column samples were not contaminated with the exception of:

-all site samples including other in Budd Inlet were found with dioxin levels over federal standards for human fish consumption.

-the drainage channel east of the former plant had six PAH compounds over health based criteria.

The remainder of the document is a detailed description of remedial action plans.

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Document Review Form

Document Review #: 22

File Name: 22_200207_Ecology_0203033.pdf		**Date of Document:** July 2002
Report Information		
Document Title: Sediment Quality in Puget Sound: Year 3, Southern Puget Sound		**Author:** Long, E., M. Dutch, S. Aasen, K. Welch et al.
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0203033.pdf		**Agency:** Ecology
Dates of Study: 1999	**Site Location:** Port/Inner Budd	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☒ PAHs ☒ Metals ☒ Mercury ☒ Pesticides ☒ PCBs ☒ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

As a component of a three-year cooperative effort of the Washington State Department of Ecology and the National Oceanic and Atmospheric Administration, surficial sediment samples from 100 locations in southern Puget Sound were collected in 1999 to determine their relative quality based on measures of toxicity, chemical contamination, and benthic infaunal assemblage structure. Findings for Budd Inlet and Port of Olympia include:

-Organic chemicals exceeded SQS and CSL values

-Two samples from Port of Olympia were the most toxic among South Puget Sound samples in the urchin fertilization toxicity tests. Fertilization success in these two samples was 0% in 100% porewater, 0% to 0.4% in 50% porewater, and 0.2% to 3.8% in 25% porewater. The high degree of toxicity observed in Port of Olympia diminished rapidly seaward into Budd Inlet, where none of the samples were toxic.

-Concentrations of benzoic acid, benzyl alcohol, and/or phenol exceeded SQS and CSL levels in the other samples from Budd Inlet and the Port of Olympia.

-The two samples from Port of Olympia had benthic results scoring 0 in benthic evaluations as they had no living organisms in them whatsoever.

-The un-ionized ammonia concentration of 398.6 ug/L was recorded in sample 242 (Port of Olympia) and it was very toxic in all three porewater concentrations.

-The toxicity of the samples was most severe in two samples (242 and 243 from Port of Olympia) in which fertilization success was 0.4% and 0.0%, respectively, in tests of 100% porewater. These two samples were also very toxic in tests of diluted porewater (0.0 and 0.4% in 50% porewater, and 0.2% and 3.8% fertilization in 25% porewater, respectively).

-Values for Port of Olympia was among the most severe response in the Microtox and Human Reporter Gene System (Cytochrome P450) Response tests. As a corollary to and verification of the cytochrome P450 HRGS toxicity test results, Columbia Analytical Services performed further chemical testing with responses recorded at 6 hours and 16 hours to identify the contribution of PAHs and dioxin/furan chemicals to the enzyme induction. In all samples, the response was much greater at 6 hours than at 16 hours, indicating the response was primarily driven by the presence of PAH chemicals and minimally attributable to the chlorinated chemicals.

-Phenol exceeded SQS and CSL values in samples from the Port of Olympia.

-Toxicity tests performed for urchin fertilization, microbial bioluminescence, and cytochrome HRGS enzyme induction indicated correspondence with complex mixtures of potentially toxic chemicals in the sediments. Often, the results of the Microtox and cytochrome P450 HRGS tests showed the strongest correlations with chemical concentrations. Whereas

the urchin fertilization tests showed correlations with chemical concentrations in northern and central Puget Sound, they failed to indicate such patterns in southern Puget Sound. As expected, given the nature of the tests, results of the cytochrome P450 HRGS assay were highly correlated with concentrations of high molecular weight PAHs and other organic chemicals known to induce this enzymatic response. In some cases, samples that were highly toxic in the cytochrome P450 HRGS tests had chemical concentrations that exceeded numerical, effects-based, sediment quality guidelines or criteria, further suggesting that these chemicals could have caused or contributed to the observed biological response. The relationships between the HRGS response and concentrations of PAHs were also observed in central and northern Puget Sound.

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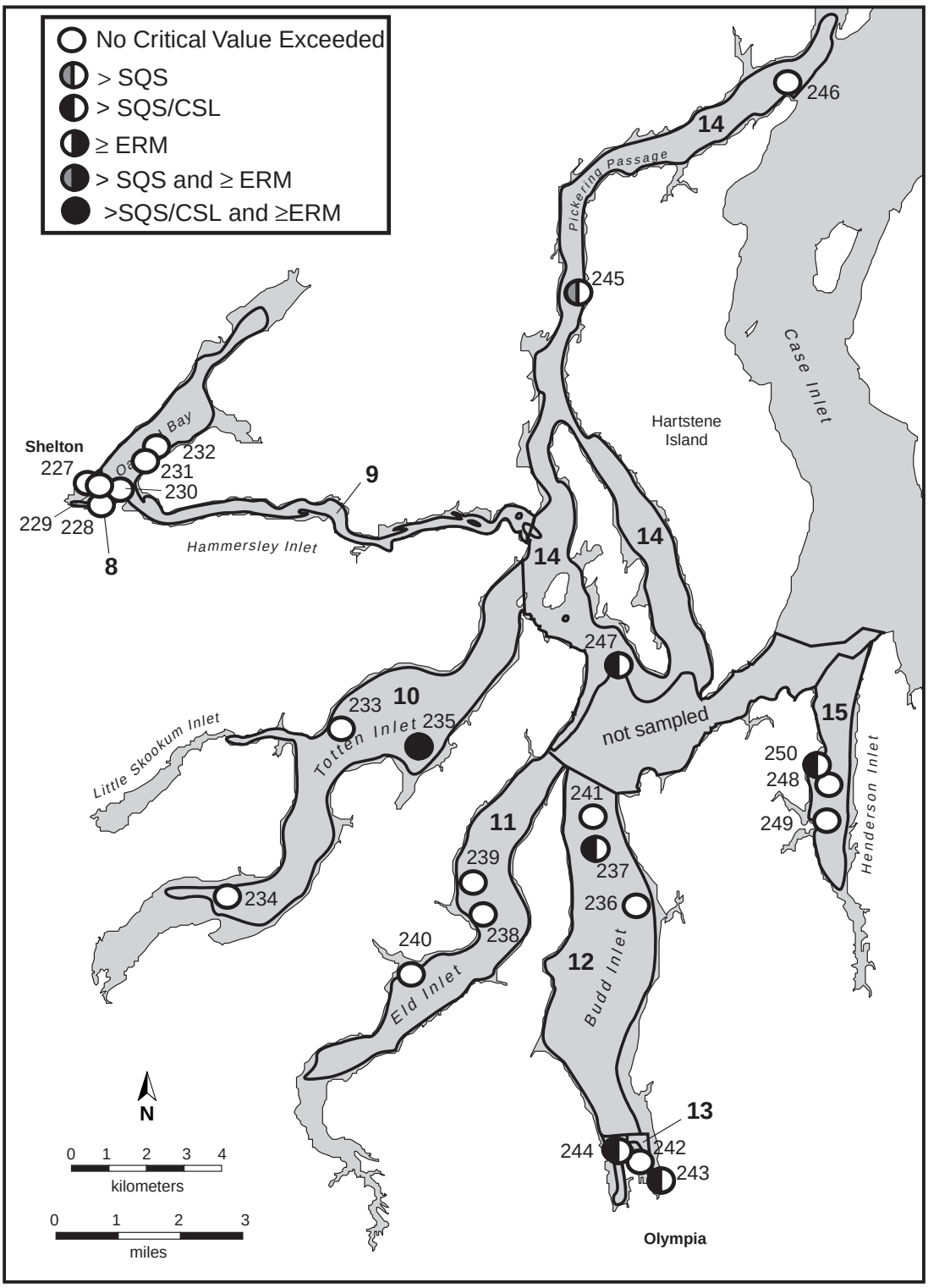

Figure 17. Sampling stations in Pickering Passage through Henderson Inlet (8 through 15) with sediment chemical concentrations exceeding numerical guidelines and Washington State criteria. (Strata numbers are shown in bold. Stations are identified as sample number).

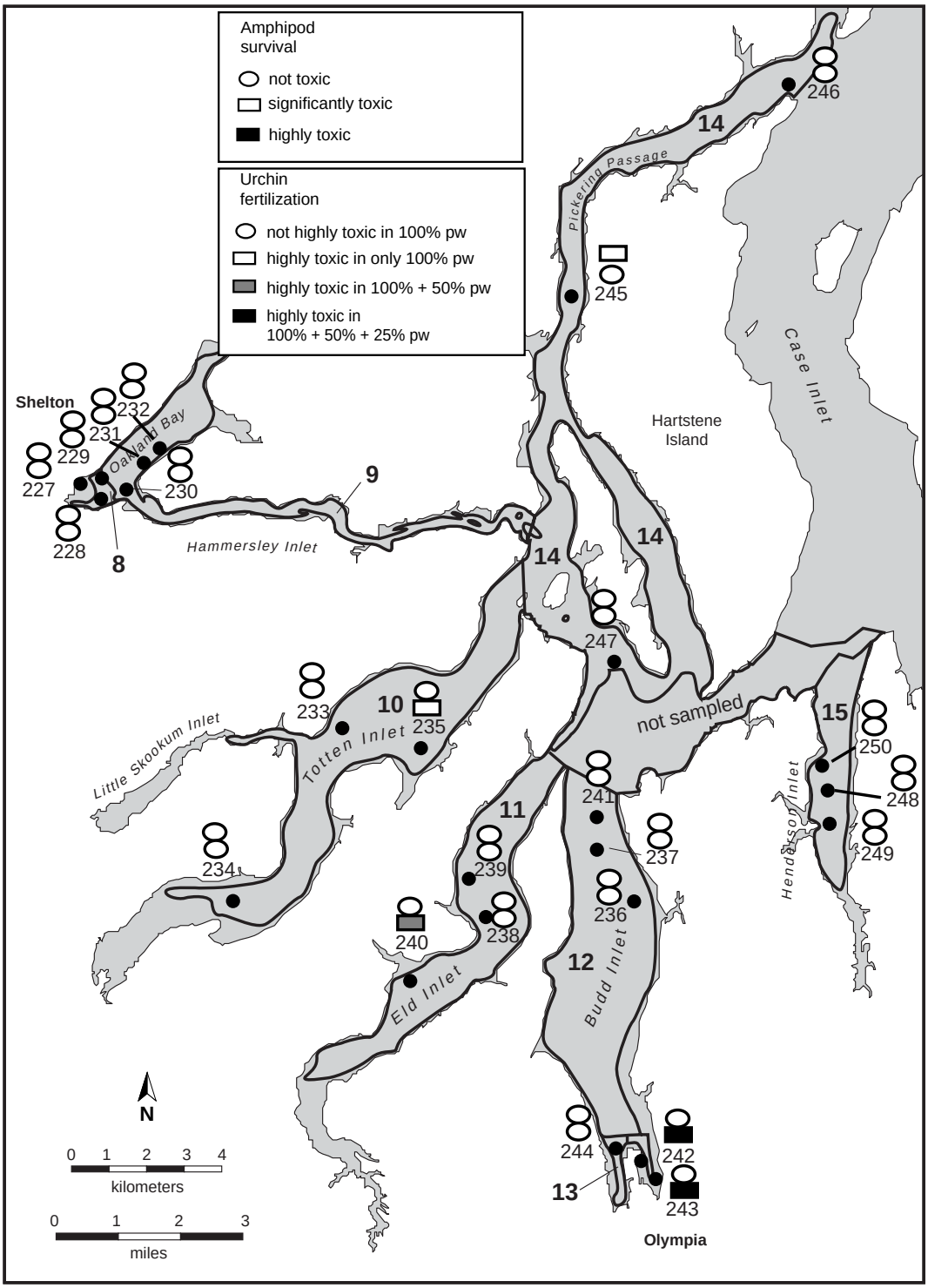

Figure 5. Summary of 1999 amphipod survival tests (top symbols) and sea urchin fertilization tests (in three porewater concentrations, bottom symbols) for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

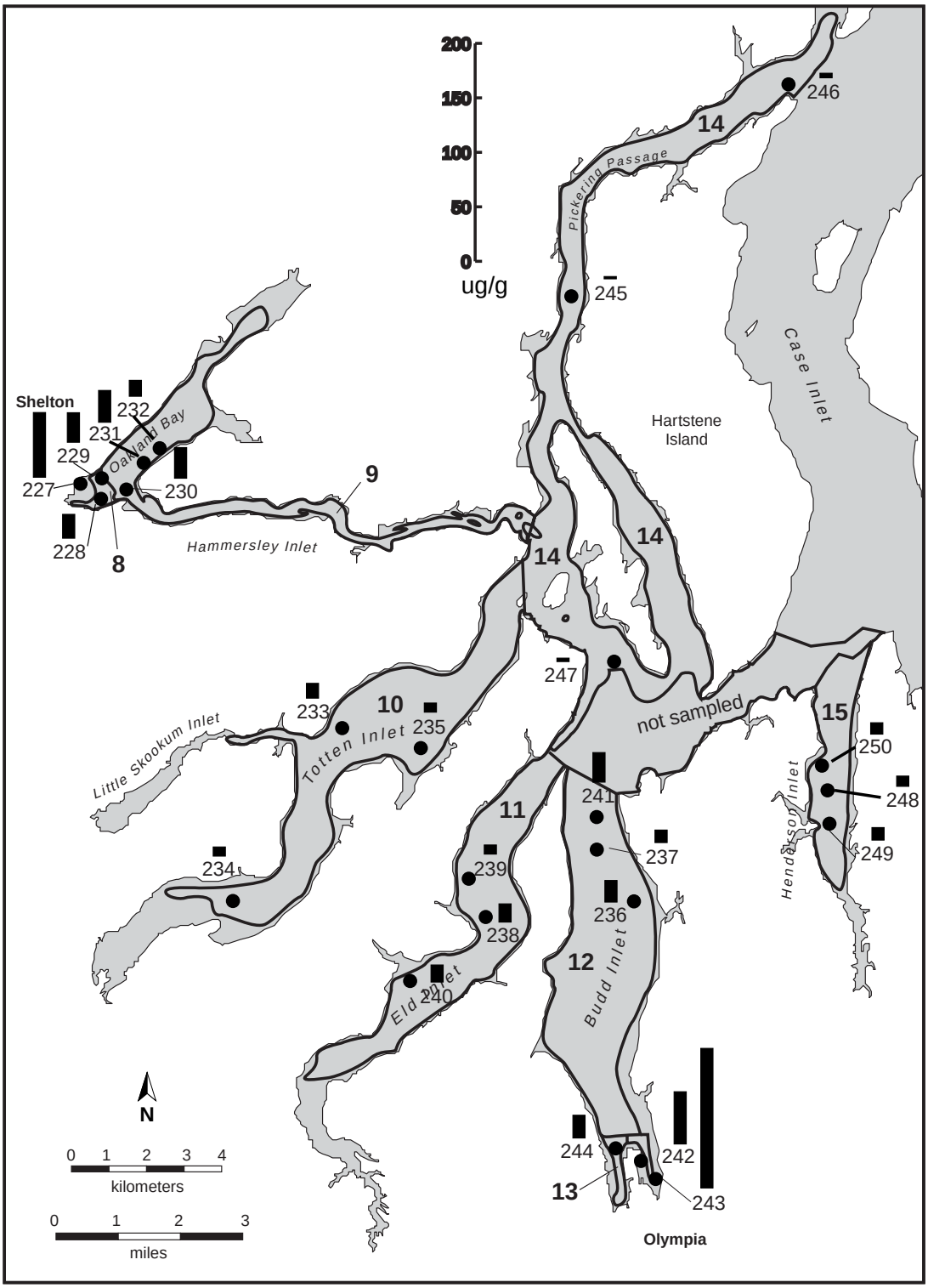

Figure 13. Results of 1999 cytochrome P450 HRGS assays (as B[a]P equivalents (µg /g)) for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

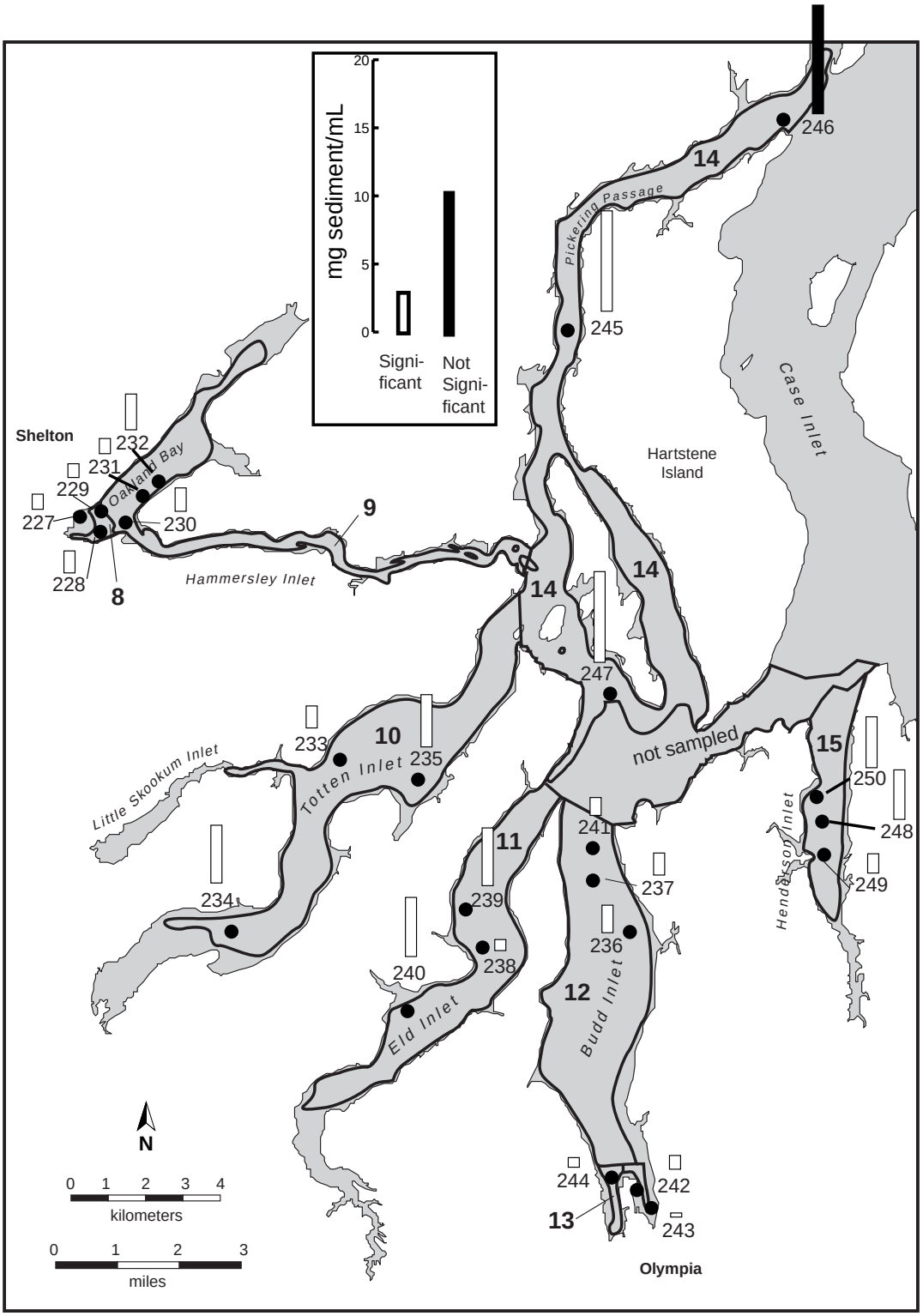

Figure 9. Results of 1999 Microtox™ bioluminescence tests for stations in Pickering Passage through Henderson Inlet (8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

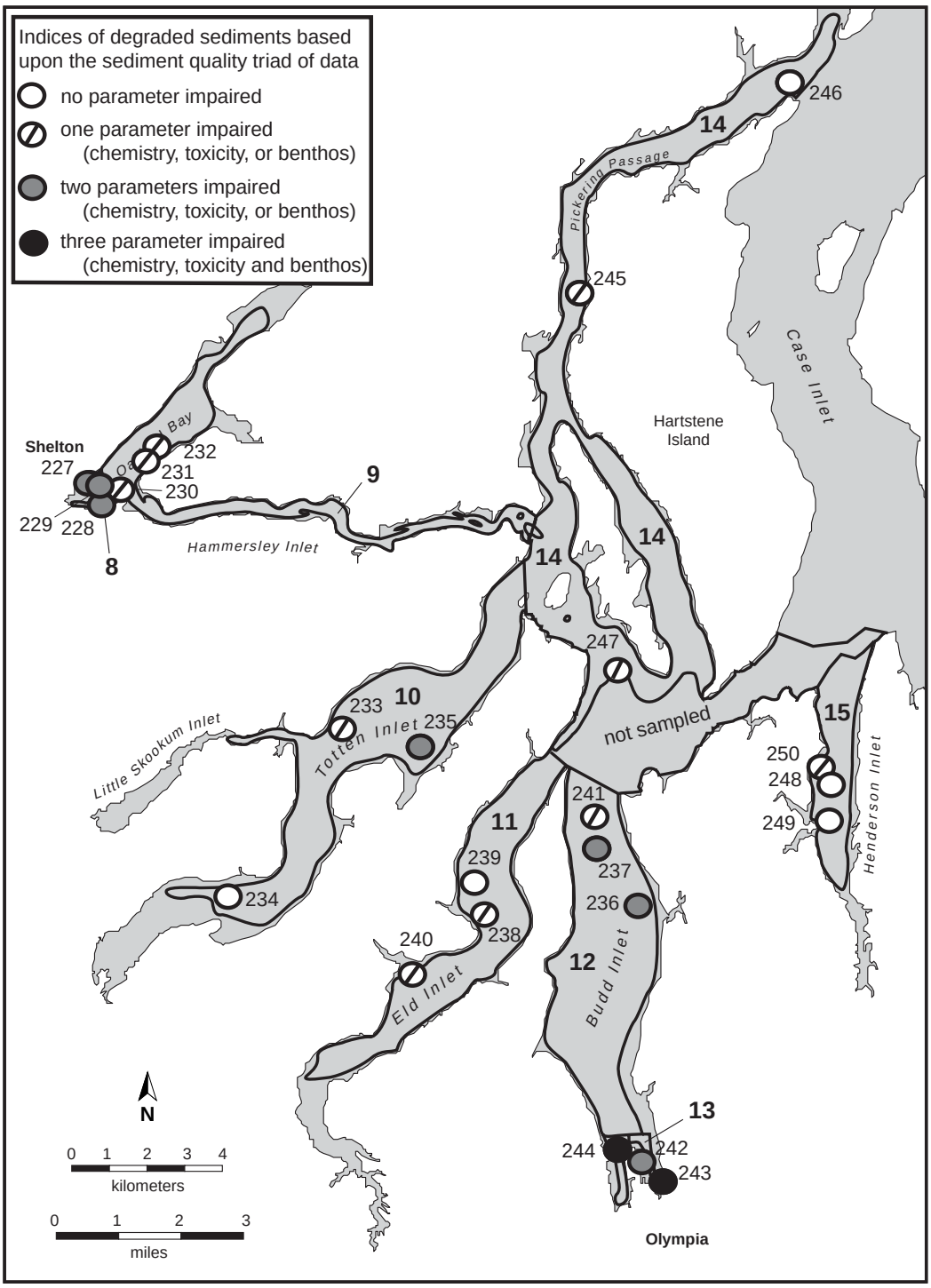

Figure 28. Classification of sediment quality at southern Puget Sound stations sampled during 1999 PSAMP/NOAA survey according to the Sediment Quality Triad of measurements – Pickering Passage through Henderson Inlet (strata 8 through 15). (Strata numbers are shown in bold. Stations are identified as sample number).

Document Review Form

Document Review #:
23

File Name: 23_200210_Ecology_0203085.pdf		**Date of Document:** October 2002
Report Information		
Document Title: Quality Assurance Project Plan; Verification of 1998 303(d) Listing for PCBs in Budd Inlet (Inner)		**Author:** Steven Golding
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0203085.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Budd Inlet	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document describes the study design, data objectives, field and laboratory procedures, and data assessment to provide more intensive sampling to determine if the 303d PCB listing for shellfish from 1998 (based on one grab composite sample of shellfish tissue) is still warranted. The results of this study can be found in Verification of 1998 303(d) PCB Listing, Inner Budd Inlet (Document 25).

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Document Review Form

Document Review #: 24

File Name: Electronic file not available		**Date of Document:** 5/13/1999
Report Information		
Document Title: Quality Assurance Project Plan; Verification of 1998 303(d) Listing for PCBs in Budd Inlet (Inner)		**Author:** International Technology Corp.
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Budd Inlet	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Summary of Findings		
Upland portion of site addressed only.		

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Document Review Form

Document Review #: 25

File Name: 25_200304_Ecology_0303016.pdf		**Date of Document:** April 2003
Report Information		
Document Title: Verification of 1998 303(d) PCB Listing, Inner Budd Inlet		**Author:** Golding, S.
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/0303016.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Budd Inlet	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☒ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Inner Budd Inlet was placed on the 1998 303(d) list for polychlorinated biphenyls (PCBs) based on a single composite sample of mussels collected from a culvert at the mouth of Moxlie Creek where it enters East Bay. That sample had a total PCB concentration of 21 µg/Kg wet weight (ww). (EIM Study ID: WSPMP95M; EIM data download: Y).

This document summarizes more intensive sampling of mussels conducted on September 6, 2002, to determine if the Inner Budd Inlet PCB listing continues to be warranted. Samples of blue mussel (Mytilus trossulus) from the sites in East Bay were found to have PCB concentrations ranging from 7.0 to 9.6 µg/Kg ww. All of these concentrations exceed the current 303(d) listing criterion of 5.3 µg/Kg ww. The PCB mixture found was in a form most closely resembling PCB 1254. A fourth site at Priest Point Park had an estimated PCB 1254 concentration of 3.0 µg/Kg ww.

EIM study ID: SGOL004

EIM data download: Y

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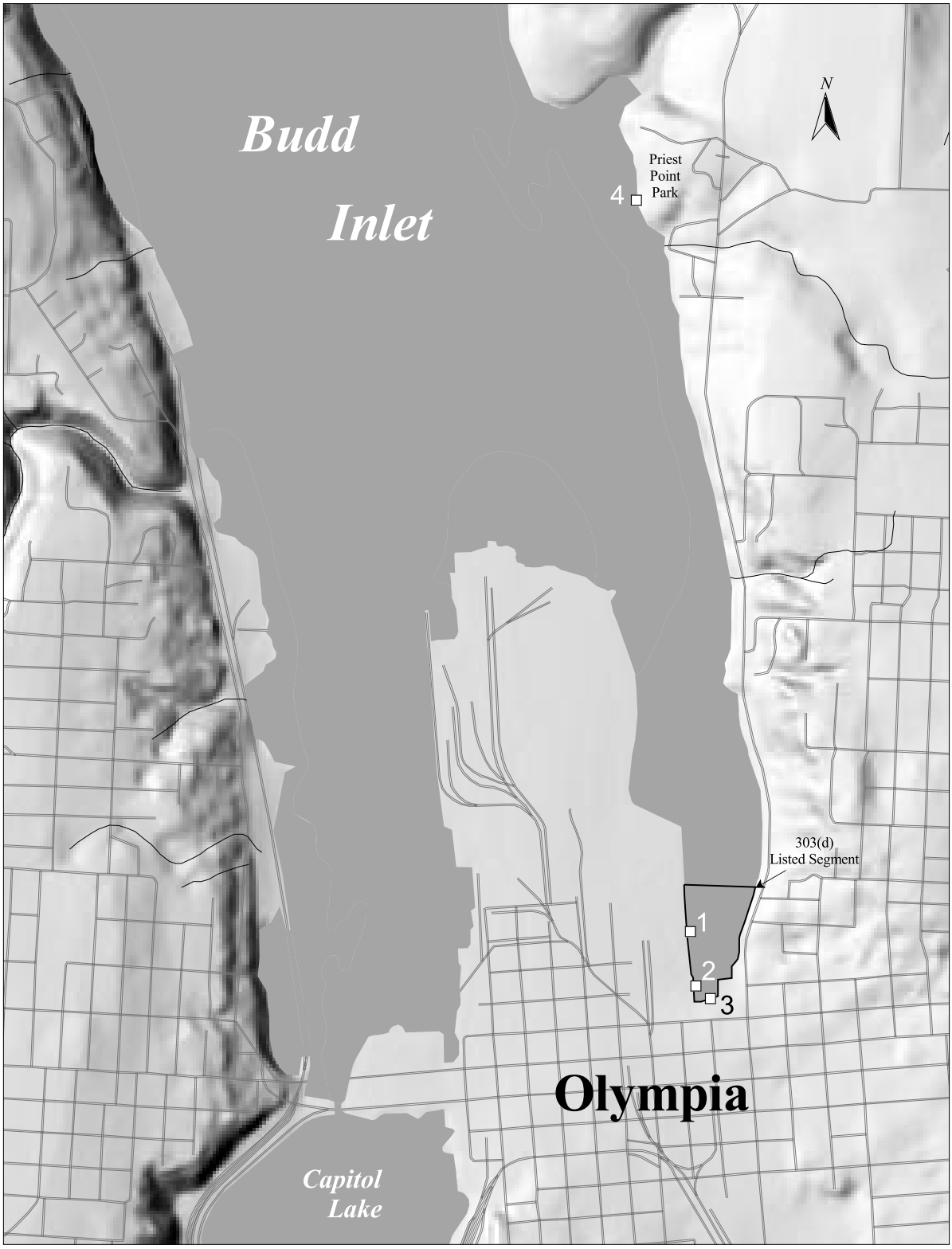

□ – mussel monitoring site

Figure 1. Budd Inlet Mussel Sampling Locations.

Document Review Form

Document Review #: 26

File Name: Electronic file not available		**Date of Document:** 10/27/1998
Report Information		
Document Title: Construction Documentation Report: Interim Remedial Action Proposed Cutoff Wall and Storm Drain Remediation - Cascade Pole Site, Olympia, Washington		**Author:** Landau Assoc.
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Document summarizes construction schedule, operations, maintenance costs of the interim remedial action at Cascade Pole in 1996 and 1997. Site history section states that contaminated sediment was discovered in 1983 and led to investigations including:

-RI of onshore portion of site in 1985 by AGI

-FS of onshore portion of site in 1988 by AGI

-1992 Supplemental Site Investigations (SSI) by ESE (onshore) and Landau (sediment).

Site was listed under MTCA in 1990. Interim remedial action included groundwater treatment and extraction of LNAPL (12/1992) and of DNAPL using a trench (2/1993). In November and December 1993 a steel sheet pile barrier wall was installed "…to minimize transport of DNAPL to the East Bay of Budd Inlet…."

Section 1.4, nature and extent of contamination, refers to supplemental site investigations in 1992. Supplemental site investigations by ESE and Landau were not found in the document search.

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Document Review Form

Document Review #: 27

File Name: Electronic File not available		**Date of Document:** 10/28/1992
Report Information		
Document Title: Risk Assessment - Sediment Operable Unit - Cascade Pole Site, Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document is a baseline risk assessment (RA) and identifies the consituents of concern (COC), and presents exposure assessment, toxicity assessment, and risk characterization. COC's identified were volatile organics, PAH, phenols, dioxin/furan compunds, and metals.

Data was used from RI and from pre-RI investigations. RI investigations included Phase I and II sediment studies (117 sediment samples, 26 seep samples, 2 clam samples). Pre-RI data included 32 sediment samples and 6 seep samples.

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Document Review Form

Document Review #:
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File Name: Electronic file not available		**Date of Document:** 10/18/1993
Report Information		
Document Title: Feasability Study Sediment Operable Unit, Cascade Pole Site, Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document covers the site history and describes, in detail, the remedial alternatives for the sediment operable unit (SOU) to the multiple benefits line (MBL) and a detailed analysis of each alternative. Data associated with the remedial alternatives analysis is form the RI and SSI studies refered to in other documents and downloaded from EIM.

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Document Review Form

Document Review #: 29

File Name: 29_199001_Ecology_90e58.pdf		**Date of Document:** November 1990
Report Information		
Document Title: Chemical Contaminants in Surface Runoff from the Abandoned Cascade Pole (Olympia) Wood Treating Facility		**Author:** Dale Norton
Location of Report (URL, Source): http://www.ecy.wa.gov/pubs/90e58.pdf		**Agency:** Ecology
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

To characterize surface water discharges at the CP site, sampling was conducted at three locations (see map):

- a 6" drain

- the NPDES outfall

- and overland flow.

Sampling events were timed to occur during a low tide period following sufficient rainfall to produce overland flow at the site.

Analysis included metals, herbicides, PAHs, VOA, and Dioxin.

Polychlorinated dibenzodioxin (CDD) and dibenzofuran (CDF) analysis of stormwater samples from the CP site included detectable levels of at least two or more CDD and CDF congeners in all samples analyzed. The most acutely toxic form, TCDD, was not detected in any of the discharges sampled.

Two chlorophenols, PCP and 2,3,4,5-tetrachlorophenol, were present at detectable levels in all the discharges sampled. The highest concentrations were found in discharge from the NPDES outfall??

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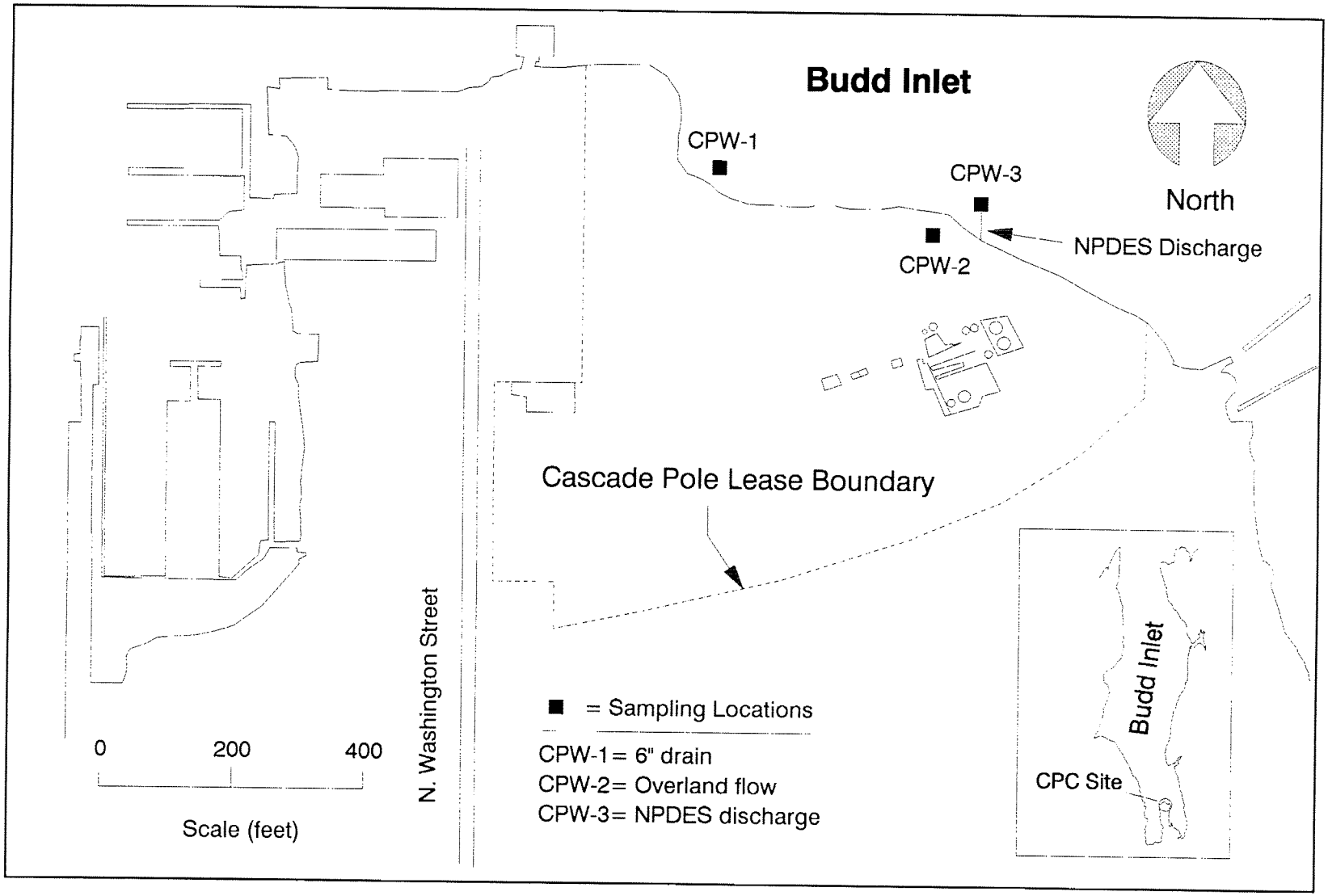

Figure 1: Sampling locations for Cascade Pole stormwater investigation.

Document Review Form

Document Review #:
30

File Name: 30_200609_Ecology_2006-186.html	**Date of Document:** September 14, 2006

Report Information

Document Title: Joint news release from the Dredged Material Management Program, consisting of the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and the Washington departments of Ecology and Natural Resources		**Author:** NA
Location of Report (URL, Source): http://www.ecy.wa.gov/news/2006news/2006-186.html		**Agency:** DMMP
Dates of Study: NA	**Site Location:**	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The news release describes DMMP and the findings of the suitability determination for disposal of material from proposed dredging in Port of Olympia navigation channel. The DMMP agencies determined that dioxin levels in more than half the material to be dredged are high enough that they need to be disposed on land or in a confined, aquatic disposal site.

The news release documented a health advisory issued by Thurston County Health Department recommending that shellfish harvested from the south end of Budd Inlet near Swantown Marina may not be eaten due to chemical contamination (including dioxin).

The last maintenance dredging in Budd Inlet occurred in the 1970s and disposal of that material was not mentioned. A plan is in the works to accomplish both priority dredging for navigation and removal of significant quantities of dioxins from the marine environment that may be subject to erosion/re-suspension as vessels transit the channel and berthing areas.

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Document Review Form

Document Review #:
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File Name: 31_200610_Port of Olympia_061023.htm		Date of Document: October 2006
Report Information		
Document Title: Port of Olympia Commission: Minutes of Regular Meeting - October 23, 2006		**Author:**
Location of Report (URL, Source):		**Agency:** Port of Olympia
Dates of Study: NA	**Site Location:** Port of Olympia	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

Ms. Andrea Fontenot, Public Works Director, provided the Commission with a PowerPoint presentation on the Port of Olympia dredging project. She reviewed the Maintenance Dredge Project and the maritime history of the marine terminal. Ms. Fontenot outlined the project and the sediment management program that included testing in 1999 and 2006 and the results of the testing. Addressing the dioxin issue, she commented that until further testing is done, the source of the dioxin is unknown, however, there are three known potential sources: urban storm water, historical land uses, and airborne particles. Concerns were raised by attendees regarding health risks, dispersal of contaminants during dredging, and how long the contamination issue has been known. Jay Manning, Director of Ecology responded that issues have been known around the Cascade Pole site since the late 70's and early 80's, but recent findings are the first indication of contamination outside that area.

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Document Review Form

Document Review #:
32

File Name: 32_200611_Ecology_0703101draft.pdf		**Date of Document:** November 2006
Report Information		
Document Title: DRAFT- South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen Quality Assurance Project Plan		**Author:** Storrs "Skip" Albertson, Julia Bos, Karol Erickson, Greg Pelletier, Carol Maloy, and Mindy Roberts
Location of Report (URL, Source): www.ecy.wa.gov/biblio/0703101.html		**Agency:** Ecology
Dates of Study: NA	**Site Location:** South Puget Sound	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document is the study plan for determining how nitrogen from a variety of sources affects dissolved oxygen levels in South Puget Sound. Collection of water quality data will occur over a 16-month time-span (July 2006 through October 2007) from 90 Puget Sound marine sites at various depths, including 20-30 wastewater treatment plants (direct discharge to Puget Sound). The document mentions fish kills in Budd Inlet related to low D.O. problems but does not discuss sediment or tissue contamination.

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Document Review Form

Document Review #: 33

File Name: Electronic File not available		**Date of Document:** 10/18/1993
Report Information		
Document Title: Feasability Study Sediment Operable Unit, Cascade Pole Site, Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This document covers the site history and describes, in detail, the remedial alternatives for the sediment operable unit (SOU) to the multiple benefits line (MBL) and a detailed analysis of each alternative. Refers to data inother documents.

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Document Review Form

Document Review #:
34

File Name: Electronic file not available		**Date of Document:** 9/28/2006
Report Information		
Document Title: Ecology Review Draft Groundwater Monitoring Report - June 2005 and March 2006		**Author:** Landau
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study: 6/2005, 3/2006	**Site Location:**	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The document covers the gorundwater monitoring program objectives, procedures, and results. No dioxin analysis was performed. cPAH exceednaces within the groundwater containment area were documented with MW-01S having the most exceedances including PCP and TPH.

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Document Review Form

Document Review #:
35

File Name: Electronic File not available		**Date of Document:** 7/10/1992
Report Information		
Document Title: Supplemental Site Investigation Report		**Author:** ESE
Location of Report (URL, Source): Ecology Archive		**Agency:** Port of Olympia
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☐ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Summary of Findings		
This document covers an investigation of the upland portion of the site that supplements the RI.		

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Document Review Form

Document Review #: 36

File Name: 36_2003 Monitoring Rpt.pdf		**Date of Document:** 1/31/2003
Report Information		
Document Title: Data Report: Post-Sediment Remediation Dioxin Testing and Fish Tissue Monitoring Cascade Pole Sediment Remediation Site. Olympia, Washington		**Author:** Landau
Location of Report (URL, Source): NA		**Agency:** Port of Olympia
Dates of Study: April - June 2002	**Site Location:** Cascade Pole	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☒ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☒ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This report presents the results of post-construction surface sediment and fish tissue dioxin testing near the Cascade Pole site. Nine surface sediment samples were collected in April 2002 from outside the remediation area, but within a 3000 foot radius. Surface sediment was analyzed for dioxin and concentrations ranged from 0.510 ng/kg TEQ at station CP-21-S (near Priest Point Park) to 22.4 ng/kg TEQ at station CP-25-S (northeast of the Cascade Pole site).

Three juvenile chinook salmon tissue samples were collected using a beach seine within the MBL in May-June 2002. Site salmon tissue dioxin concentrations ranged from 0.244 to 0.679 ng/kg TEQ and the hatchery fish had a dioxin TEQ concentration of 0.028 ng/kg.

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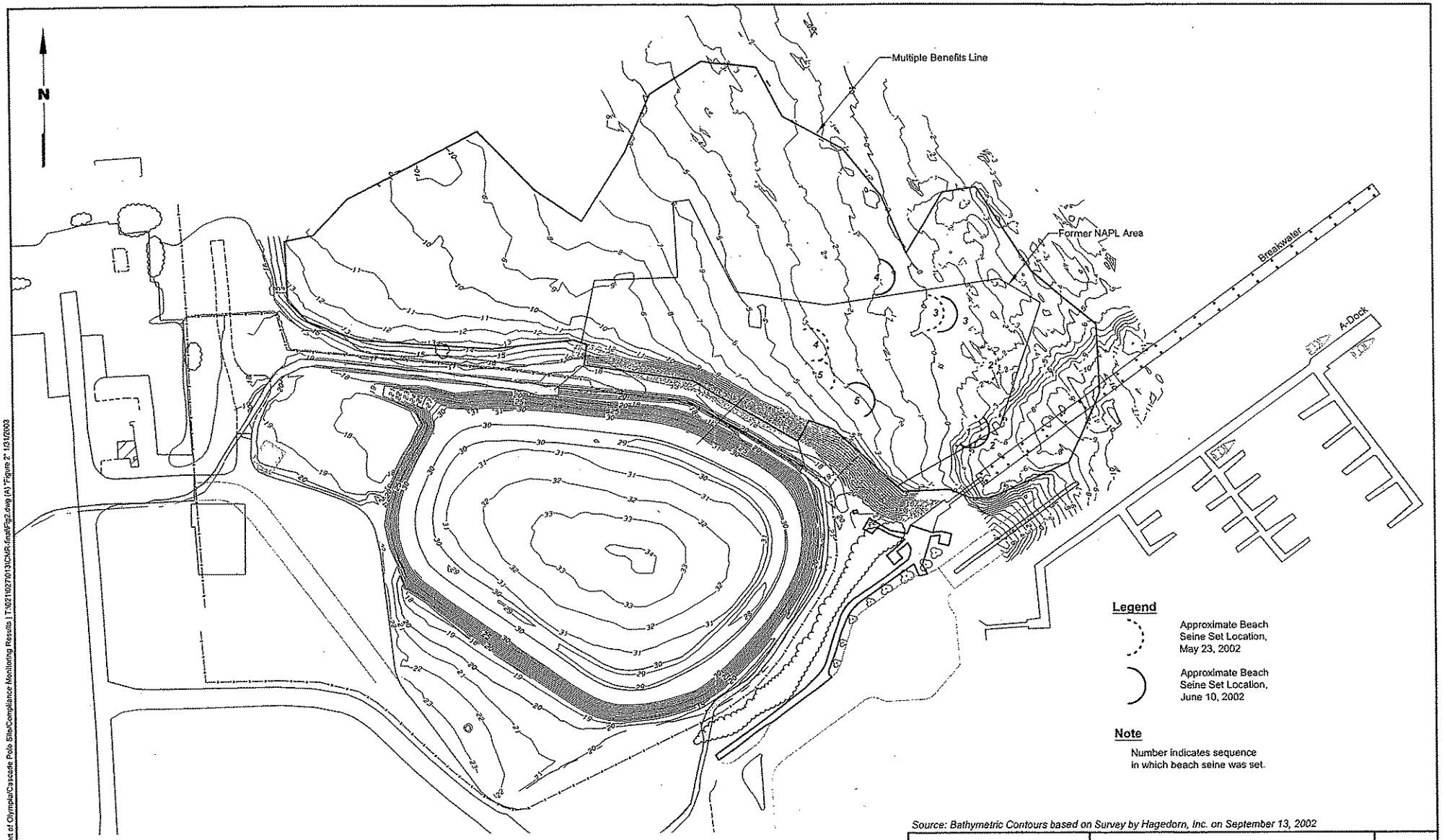

Source: Bathymetric Contours based on Survey by Hagedorn, Inc. on September 13, 2002

Cascade Pole Site Olympia, Washington	**Beach Seining Locations**	Figure 2

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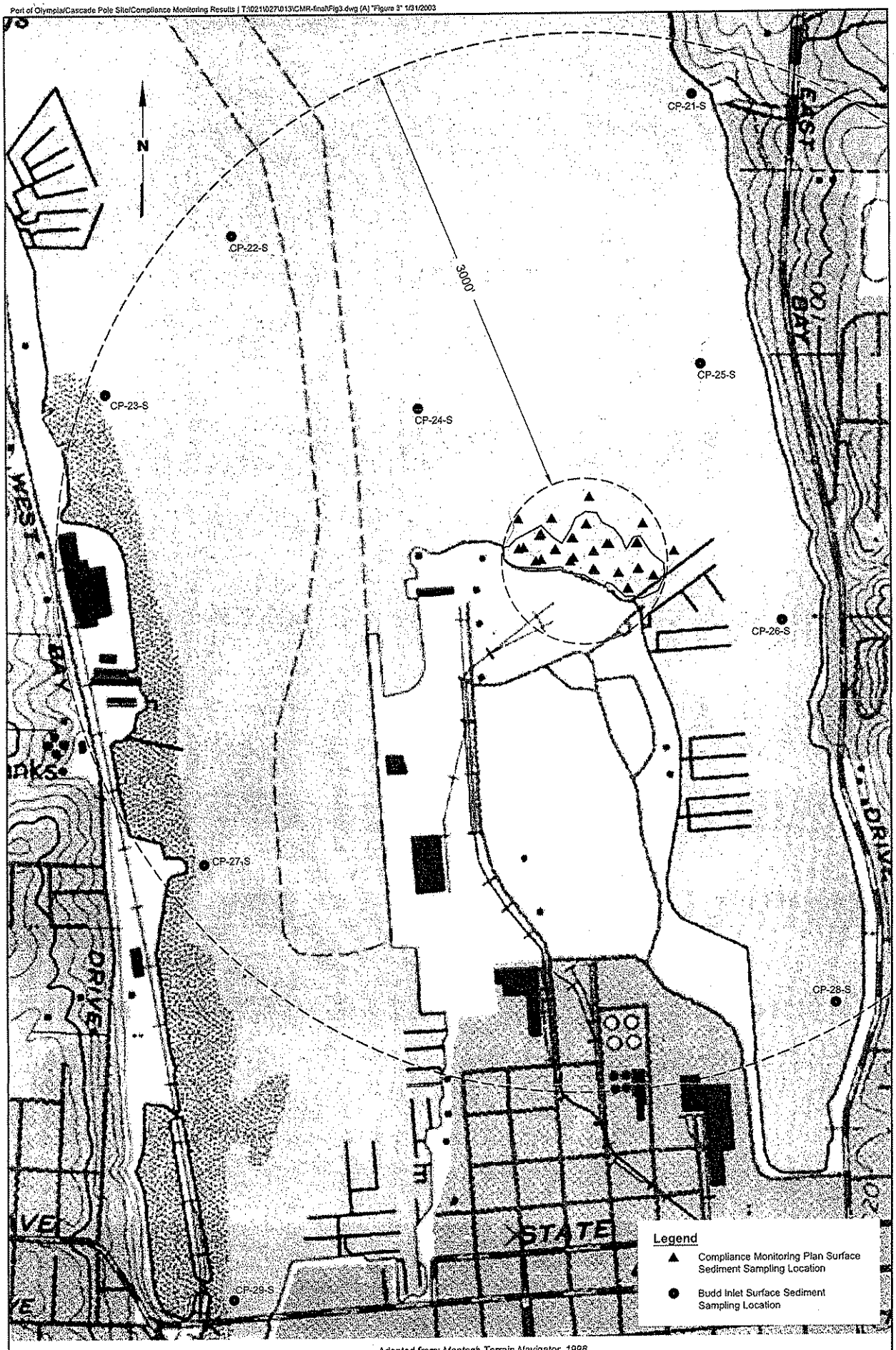
Port of Olympia/Cascade Pole Site/Compliance Monitoring Results | T:\021\027\013\CMR-final\Fig2.dwg [A] "Figure 2" 1/31/2003

Port of Olympia/Cascade Pole Site/Compliance Monitoring Results | T:\021\027\013\CMR-final\Fig3.dwg (A) "Figure 3" 1/31/2003



Adapted from: Maptech Terrain Navigator, 1998

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0 600 1200
Scale in Feet

Cascade Pole Site
Olympia, Washington

Surface Sediment Sampling Locations

Figure 3

Document Review Form

Document Review #: 37

File Name: 37_sediment.pdf		**Date of Document:** 2003
Report Information		
Document Title: Additional Confirmational Monitoring, Post-Construction Sediment Compliance Monitoring Report, Cascade Pole Site, Olympia, WA.		**Author:** Landau
Location of Report (URL, Source): NA		**Agency:** Port of Olympia
Dates of Study: September 2003	**Site Location:** Cascade Pole	**Site Map Attached?** ☒ Yes ☐ No
Sediment Parameters Measured:	☒ Dioxins/furans ☒ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

This confirmatory monitoring report is a follow up to to the initial April 2002 Post-Construction Sediment Compliance Monitoring and summarizes the findings of interior backfill sampling. Under the monitoring approach, three interior backfill samples and three surface samples we were collected in the same locations as 2002 dredge interface sample exceedances. Interior backfill samples were analyzed and surface samples were archived. Concentrations in the backfill material were below cleanup levels and the results were considered in compliance.

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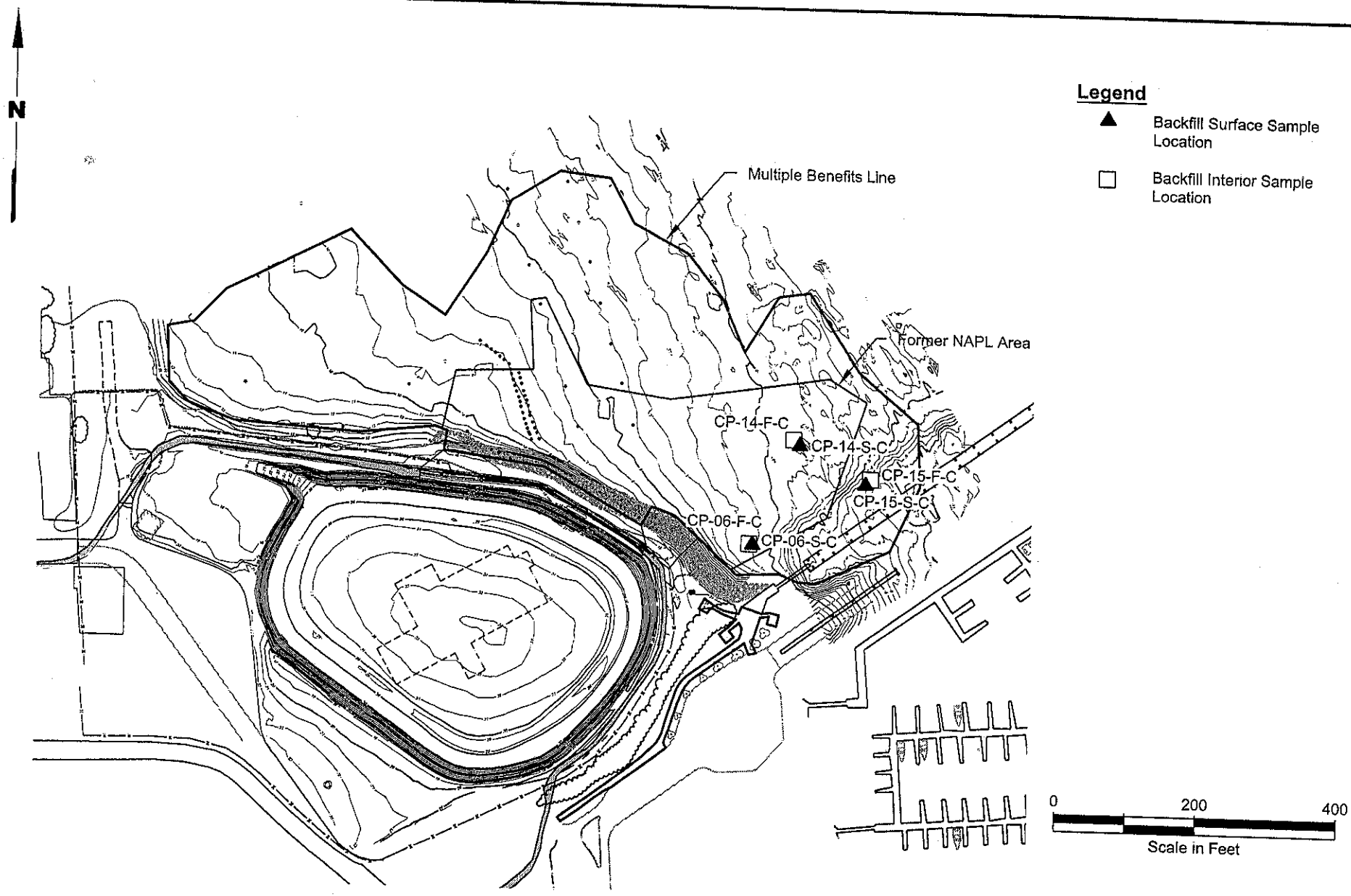

Source: Bathymetric Contours based on Survey by Magedorn, Inc. on September 13, 2002

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Cascade Pole Site Olympia, Washington	**Sampling Locations for Sediment Confirmational Monitoring September 2003**	Figure 2

Document Review Form

Document Review #:
38

File Name: 38_Final CPC Cleanup Action Plan.doc		**Date of Document:** March 8, 2000
Report Information		
Document Title: CLEANUP ACTION PLAN. CASCADE POLE COMPANY SITE - SEDIMENTS OPERABLE UNIT		**Author:** Ecology
Location of Report (URL, Source): Ecology		**Agency:** Ecology
Dates of Study:	**Site Location:** Cascade Pole	**Site Map Attached?** ☐ Yes ☒ No
Sediment Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	
Tissue Parameters Measured:	☐ Dioxins/furans ☐ PAHs ☐ Metals ☐ Mercury ☐ Pesticides ☐ PCBs ☐ Butyltins ☐ Other	

Summary of Findings

The Cleanup Action Plan (CAP) was prepared to satisfy the requirements of the Model Toxics Control Act (MTCA) and describes the Cascade Pole site, including history and extent of contamination, identifies site-specific cleanup standards for the Sediments Operable Unit and interim remedial actions, and summarizes the remedial alternatives presented in the Sediments Feasibility Studies (FS). Among the information contained in the document is the following:

- a description of lateral distribution of creosote-related contamination (primarily to the east of the former wood-treatment plant and historical log pond, with some spreading north and northeast) and vertical distribution of the creosote-related contamination (with the highest concentrations found in the depth intervals of 10-55 cm and 55-100 cm (0.33-1.8 feet and 1.8 to 3.3 feet) below the surface of the sediment). The vertical extent of wood treatment-related contamination generally was found to be limited by the presence of an underlying silt and clay layer.

- mention of two sediment surface water exceedance issues (from ponded on or flowing in channels in the surface of the sediment):

1) all site water samples (as well as those taken elsewhere in Budd Inlet as a basis of comparison to site samples) obtained during the Sediments RI contained dioxin above the federal criteria that address human consumption of fish from the marine environment (as well as those taken elsewhere in Budd Inlet as a basis of comparison to site samples). The source of this information was not cited.

2) one drainage channel, just east of the former wood treatment plant, flowing in the channel at low tide contained chemical concentrations that exceeded health-based water quality criteria for six PAHs.

-Clams from onsite contained levels of wood-treating chemicals significantly above concentrations reported in clam samples that were obtained from Eld Inlet.

The document identifies and describe the selected remedial alternative for the Sediments Operable Unit.

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