DEPARTMENT OF
ECOLOGY
State of Washington

Quality Assurance Project Plan

General Characterization of PCBs in South Lake Washington Sediments

March 2009

Publication No. 09-03-106

Publication Information

This plan is available on the Department of Ecology's website at www.ecy.wa.gov/biblio/0903106.html.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search User Study ID, BERA0006.

Ecology's Project Tracker Code for this study is 09-254.

Waterbody Number: WA-08-9350

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Quality Assurance Project Plan

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March 2009

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WQP - Water Quality Program
NWRO - Northwest Regional Office
EIM - Environmental Information Management system
EAP - Environmental Assessment Program
SCS – Statewide Coordination Section

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Abstract

Each study conducted by the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance (QA) Project Plan. The plan describes the objectives of the study and the procedures to be followed to achieve those objectives. After completion of the study, a final report describing the study results will be posted to the Internet.

This QA Project Plan describes a study being conducted by Ecology in collaboration with the King County Department of Natural Resources and Parks.

The primary goal of the study is to characterize PCB concentrations in bottom sediments in the portion of Lake Washington south of Interstate 90.

Objectives of the study are to:

1. Identify potential *hot spots* of PCB concentrations near the shoreline areas of south Lake Washington.
2. Evaluate PCB deposition trends in south Lake Washington by analysis of an age-dated sediment core.

Background

Lake Washington is the largest of the three major lakes in King County, and the second largest natural lake in the state of Washington. It is located just east of Puget Sound between the cities of Seattle and Bellevue (Figure 1). Lake Washington has two major tributaries: (1) Cedar River at the southern end, which contributes about 57% of the annual surface water flow and (2) Sammamish River in the north, which contributes 27% of the surface water flow. The remainder of the water comes from small local drainages and groundwater. The majority of the immediate watershed is highly developed and urban in nature with 63% fully developed. The upper portion of the Cedar River watershed is part of the Seattle Water Department drinking water supply which is closed to public access (King County, 2009).

Lake Washington is a deep, narrow, glacial trough with steeply sloping sides. It is sculpted by the Vashon ice sheet, the last continental glacier to move through the Seattle area. The lake is 20.6 feet above mean lower low tide in Puget Sound. The Lake Washington Ship Canal was constructed in 1916 and is the only outlet from Lake Washington to Puget Sound via Lake Union and the Ballard Locks. Construction of the canal resulted in the lowering of the lake 9 feet to its present level, leaving the Black River dry and the Cedar River diverted into Lake Washington. Mercer Island lies in the southern half of the lake. It is separated from the east shore by a relatively shallow and narrow channel and from the west shore by a much wider and deeper channel (King County, 2009).

The lake received increasing amounts of treated sewage between 1941 and 1963, which resulted in eutrophication and impaired water quality of the lake. Planktonic algae were dominated by blue-green bacteria algae from 1955 to 1973. Except for combined sewer overflows, all sewage discharges were diverted from the lake by 1968. Rapid and predicted water quality improvements followed. Blue-green algae decreased and has been relatively insignificant since 1976 (King County, 2009).

In the late 1990s, King County began a project to further understand hydrodynamics, nutrients, and other contaminants in Lake Washington. As part of this project, King County collected fish tissue data for the first time. Resident fish species were collected and analyzed for polychlorinated bi-phenyls (PCBs), mercury, and other contaminants. Based on the PCB levels, the Washington State Department of Health (DOH) issued an interim fish advisory for large and small mouth bass, yellow perch, cutthroat trout, and northern pikeminnow (DOH, 2004).

Monitoring of freshwater fish tissue in Washington State by Ecology in 2004 and 2005 concluded that Lake Washington ranked second, out of 52 sites statewide, for having highly contaminated fish (Seiders et al., 2007). The highest concentrations of PCBs were measured in carp at a concentration of 1300 ug/Kg wet weight (ww). Ecology recommended determination of action for the most contaminated sites: (1) particularly in Lake Washington and (2) also in the Wenatchee, Spokane, Snake, and Columbia Rivers.

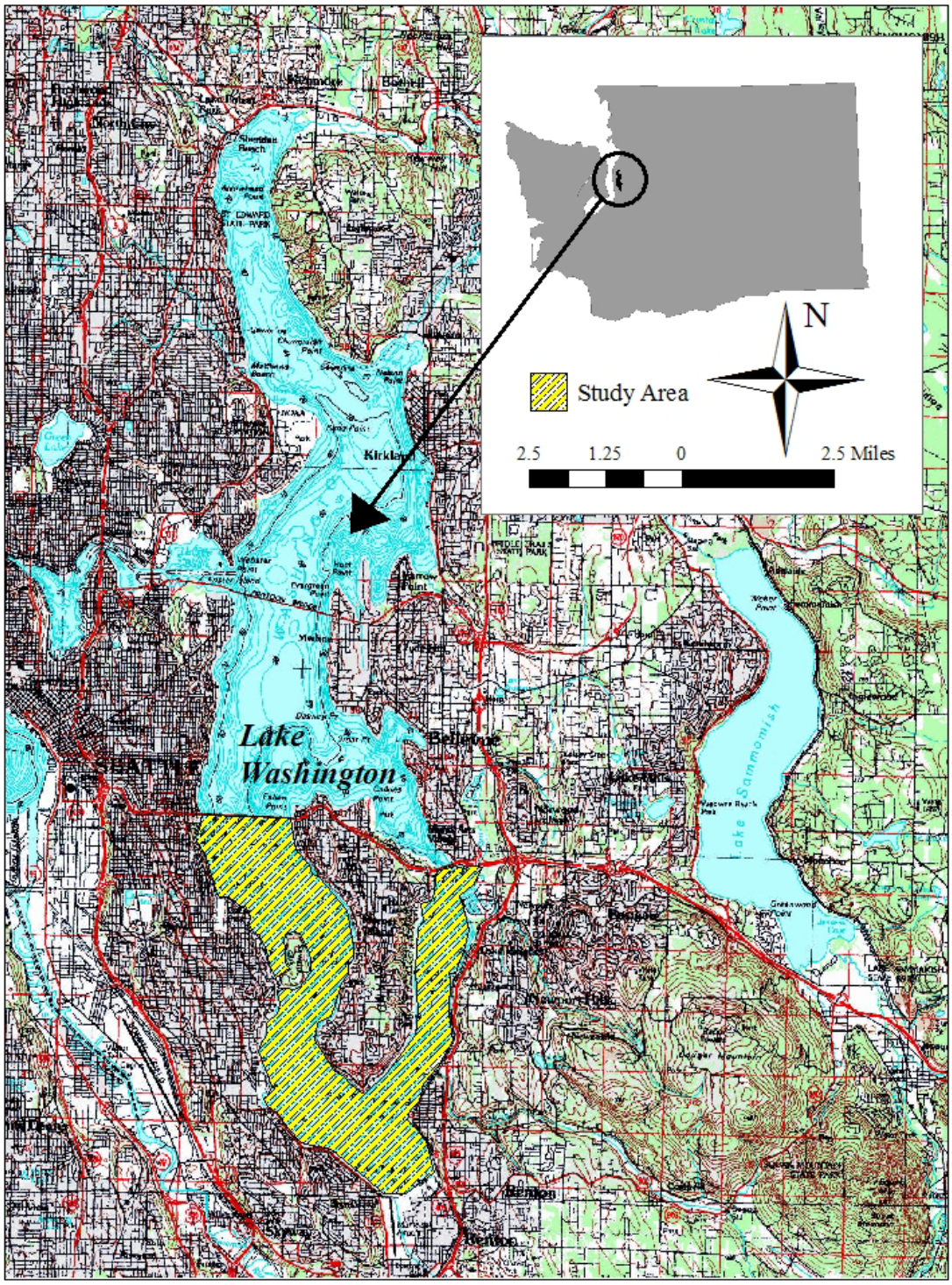

Figure 1. Lake Washington Study Area.

Historical Data on Sediments

Sediment chemistry data for south Lake Washington are very limited. Existing information on PCBs in sediments comes from two sources: King County Department of Natural Resources and Parks (DNRP) and consultant reports submitted to The Boeing Company. All samples targeted the 0-10 centimeter depth, considered to be the biologically active zone (Ecology, 2003).

King County DNRP collected a limited number of sediment samples in Lake Washington as part of its routine monitoring activities and special studies. The highest sediment concentrations were found in south Lake Washington. PCB Aroclor results for samples from south Lake Washington are available for 1992, 1995, 1996, 2000, and 2007 (Figure 2). Total PCB concentrations range from 22 to 1,690 ug/kg dry weight (dw) with the highest concentrations in the east channel offshore of the Port Quendall property and the Seattle Seahawks headquarters (King County, unpublished data).

Roy F. Weston, Inc. prepared two reports for The Boeing Company that present concentrated sampling offshore of the current Boeing Company's Renton Facility (Weston, 1997; Weston 1999). The earlier report characterizes sediment quality in nearshore sediments adjacent to the Washington State Department of Natural Resources (DNR) property and the Boeing Renton Facility. Historically, cooling water discharges from the Shuffleton Power Plant, operated by Puget Power & Light (1929-1989), entered Lake Washington via a flume.

In 1966 and 1967, Lake Washington sediments were dredged and used to fill in the nearshore between inner and outer harbor lines, thereby creating an uplands parcel owned by DNR. When this parcel was created, a new discharge flume was constructed and used for the remainder of the power plant's operating life. Ten samples were collected in the vicinity of this flume by Roy F. Weston (Figure 3). Total PCB concentrations ranged from 400 to 5400 ug/kg dw. The highest concentrations were located near the mouth of the flume.

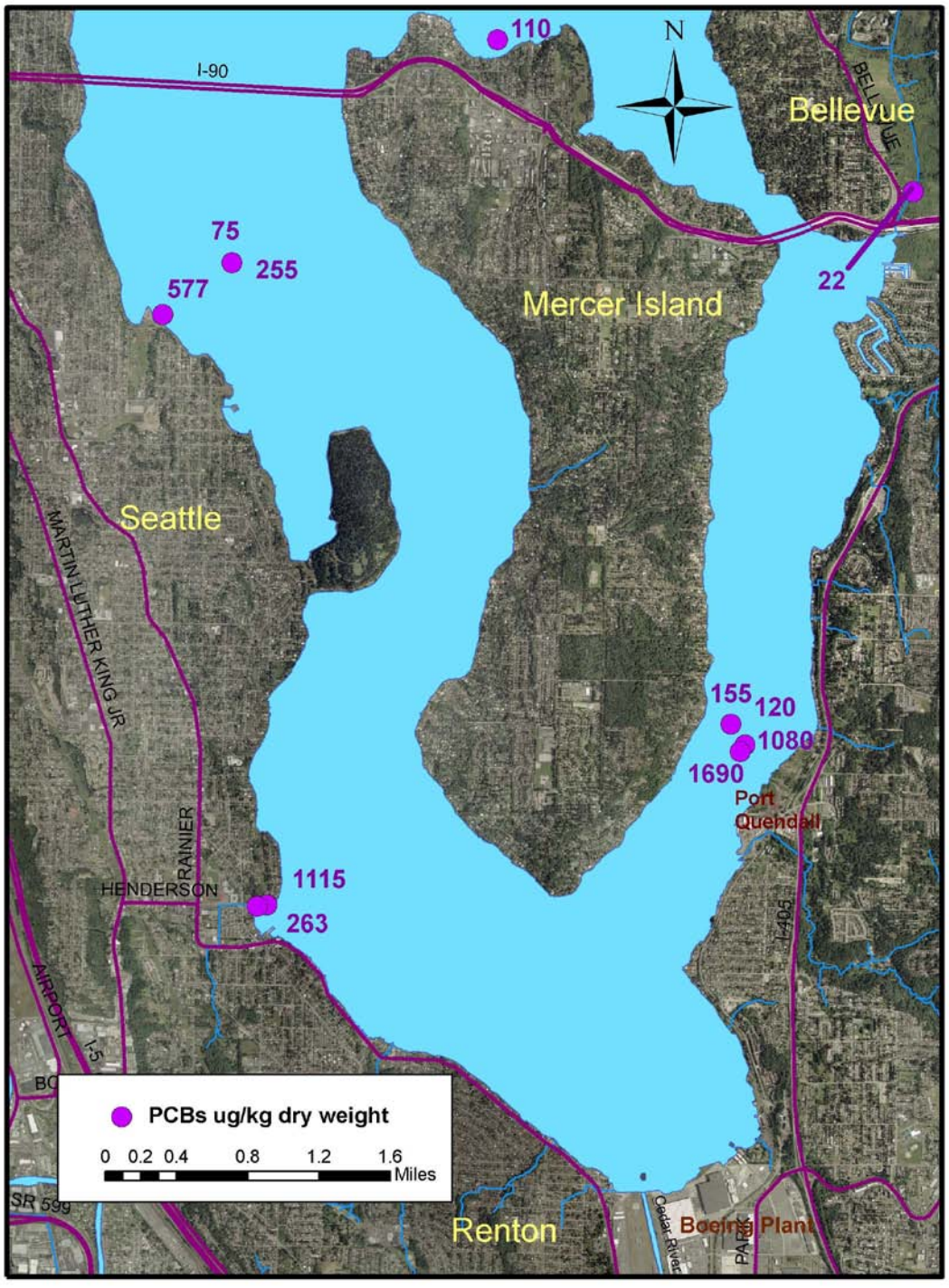

Figure 2. King County Data for Total PCBs in Sediments.

The later report was produced in compliance with an *agreed order* between The Boeing Company and Ecology which was intended to evaluate potential threats to human health and the environment from potential hazardous constituent releases by the Boeing Renton Facility (Weston 1999). Thirty-seven samples were collected near 9 stormwater outfalls at the Boeing property and 2 non-Boeing discharge points (Figure 3). Total PCB concentrations ranged from 7 to 760 ug/kg dw. The highest concentration was located about 200 feet west of the flume mouth. However, the three next highest concentrations were located much further west, about 600 to 800 feet from the flume mouth and close to shore.

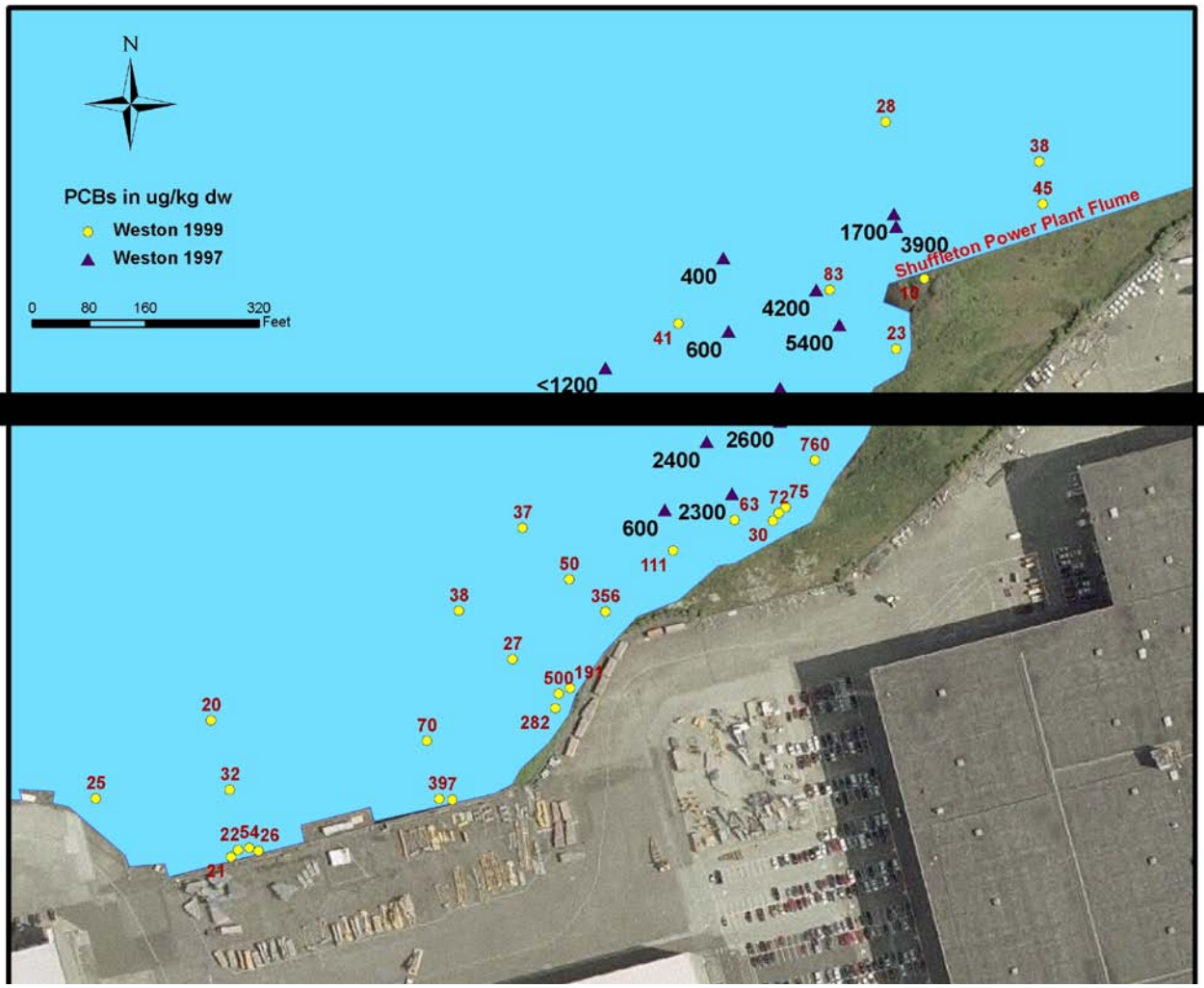

Figure 3. Historical Sediment Data Adjacent to the Boeing Renton Facility.

Project Description

This study is motivated by multiple factors including:

- Current PCB fish consumption advisory.
- Absence of adequate sediment chemistry data to characterize PCB spatial distribution throughout south Lake Washington.
- Limited historical data indicating high localized PCB concentrations in some areas of south Lake Washington.

The primary objective of the project is to screen for potential PCB hotspots in south Lake Washington by collecting surface sediments. For the purposes of the project, south Lake Washington refers to the lake area south of Interstate 90 (see Figure 1). Additional objectives include:

- Evaluating PCB deposition trends in Lake Washington by analysis of an age-dated sediment core.
- Characterizing PCB concentration gradients along three transects perpendicular to the shoreline, spanning shallow to deep water sections.

Ecology, in conjunction with King County, has identified a total of 52 discrete locations to sample surface sediments in south Lake Washington. Approximately 43 nearshore locations will be sampled to identify hot spots of PCB concentrations or potential for ongoing upland sources. If there are ongoing sources or identified hotspots, Ecology can (1) conduct further source tracking investigations as needed, (2) focus remedial actions, and (3) work with local communities and businesses to find management options to reduce the sources of PCBs to the lake.

Water depths at nearshore sampling locations will be approximately 40-60 feet. Five locations will be sampled in deep water (greater than 60 feet). Three transects will be sampled perpendicular from the shoreline out to deep water, using four additional samples to supplement some of the nearshore and deepwater locations.

In addition to the surface sediment sampling, a single sediment core will be analyzed to help determine deposition trends for PCBs over time. The sediment core was collected in August 2008, in collaboration with another Ecology study: *Depositional History of Mercury in Selected Washington Lakes Determined from Sediment Cores* (Coots, 2006). The sediment samples from the Lake Washington core are currently being held frozen at Ecology and awaiting analysis.

Organization and Schedule

The people involved in this project are listed in Table 1, and the schedule for the project is shown in Table 2.

Table 1. Organization of Project Staff and Responsibilities.

Name	Title	Responsibilities
Ecology Staff (all EAP except EAP client)		
Brandee Era-Miller TSU, SCS Phone (360) 407-6771	Project Manager and Principal Investigator	Writes the QAPP, oversees field sampling and transportation of samples to the laboratory, conducts QA review of data, analyzes and interprets data, enters data into EIM, and writes the draft and final reports.
Janice Sloan TSU, SCS Phone (360) 407-6553	Field Assistant	Helps collect samples and records field information.
Dale Norton TSU, SCS Phone (360) 407-6765	Unit Supervisor for the Project Manager	Provides internal review of the QAPP, approves the budget, approves the final QAPP, reviews the draft report, and approves the final report.
Will Kendra SCS Phone (360) 407-6698	Section Manager for the Project Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP and report.
Sinang Lee Water Quality program Northwest Regional Office Phone (425) 649-7110	EAP Client	Clarifies scope of the project, reviews the draft QAPP, approves the final QAPP, reviews the draft report, and approves the final report.
Stuart Magoon Manchester Environmental Laboratory Phone (360) 871-8801	Director	Approves the final QAPP.
William R. Kammin Phone (360) 407-6964	Ecology Quality Assurance Officer	Reviews the draft QAPP and approves the final QAPP.
King County Staff		
Richard Jack King County DNR Phone (206) 205-5151	King County Client	Assists in creating a sampling scheme for the study, co-authors the QAPP, reviews of the QAPP and final report, and assistance with field sampling.
Jenee Colton King County DNR Phone (206) 291-1970	King County Client	Assists in creating a sampling scheme for the study, co-authors the QAPP, reviews of the QAPP and final report, and assists with field sampling.

EAP - Environmental Assessment Program.
EIM - Environmental Information Management system.
QAPP - Quality Assurance Project Plan.
SCS - Statewide Coordination Section.
TSU - Toxic Studies Unit.
DNR - Department of Natural Resources.

Table 2. Proposed Schedule for Completing Field and Laboratory Work, Data Entry into EIM, and the Final Report.

Field and laboratory work	
Field work completed	March 2009
Laboratory analyses completed	June 2009
Environmental Information System (EIM) system	
EIM data engineer	Brandee Era-Miller
EIM user study ID	BERA0006
EIM study name	General Characterization of PCBs in South Lake Washington Sediments
Data due in EIM	December 2009
Final report	
Author lead	Brandee Era-Miller
Schedule	
Draft due to supervisor	August 2009
Draft due to client/peer reviewer	September 2009
Draft due to external reviewer(s)	November 2009
Final report due on web	December 2009

Quality Objectives

Quality objectives for this project are to obtain data of sufficient quality, minimize uncertainty, and produce results comparable to data from other Lake Washington studies. These objectives will be achieved by carefully following the *Sampling Procedures* and *Quality Control Procedures* described in this QA Project Plan.

Ecology's Manchester Environmental laboratory (MEL) and accredited laboratories contracted by MEL for analysis of project samples are expected to meet the measurement quality objectives (MQOs) selected for the project. The MQOs that will be used for the project are shown in Table 3. The lowest concentrations of interest are the concentrations that will meet project objectives.

Table 3. Analytical Measurement Quality Objectives.[1]

Parameter	Laboratory Control Samples	Laboratory Duplicates	Matrix Spikes Samples	Matrix Spike Duplicates	Surrogate Standards	Lowest Concentration of Interest
	% recovery limits	RPD (%)	% recovery limits	RPD (%)	% recovery limits	
PCB Aroclors	50-150	≤ 50	N/A	N/A	50-150	5 *u*g/Kg dry
PCB Congeners	50-150	≤ 50	N/A	N/A	50-150	2 *u*g/Kg dry
TOC	80-120	≤ 20	N/A	N/A	N/A	1 %
Grain Size	N/A	≤ 15	N/A	N/A	N/A	0.1%
Total Lead	85-115	≤ 20	75-125	≤ 20	N/A	2 mg/Kg dry
$Lead^{210}$	N/A	≤ 25	N/A	N/A	N/A	1 dpm*/g

[1]Quality Control (QC) limits from personal communication with MEL.
RPD = Relative Percent Difference.
PCB = polychlorinated biphenyls.
N/A = not applicable.
dpm = disintegrations per minute.

Sampling Process Design (Experimental Design)

Surface Sediments

As mentioned in the *Project Description*, Ecology collaborated with the King County Department of Natural Resources and Parks to identify sediment sampling areas in south Lake Washington.

Sediments will be collected from 52 discrete locations in south Lake Washington. These sites are shown in Figure 4 and the coordinates are listed in the Appendix, Table A-1. Sediments will be analyzed for PCB Aroclors, total organic carbon (TOC), and grain size. There will be three different sampling schemes for the surface sediments:

- 43 nearshore locations
- 5 deepwater locations
- 3 transects

Nearshore Locations

Geographic Information System layers for combined sewer overflows (CSOs) and stormwater outfalls revealed well over 150 piped discharges to south Lake Washington. The CSOs and stormwater outfalls were from King County; the cities of Seattle, Mercer Island, Renton, and Bellevue; the Coal Creek Utility District; and a visual inspection of the shoreline from boat reconnaissance. It is difficult to know how many of these discharges are currently active. Due to the complexity of trying to pinpoint PCBs in sediments to any one discharge, Ecology and King County DNRP decided to plot the nearshore sampling locations in a general pattern along the shoreline.

Approximately 43 nearshore locations were chosen to be sampled to identify potential hot spots of PCB concentrations. The locations were generally spaced 1 kilometer apart. Water depths for the targeted nearshore locations will be approximately 40-60 feet. The depth of water was chosen to (1) avoid weeds such as milfoil, which grow densely from about 3 feet to 30 feet of depth, (2) minimize wave action from surface waters, and (3) still be shallow enough to link to potential uplands sources.

Deepwater Locations

An additional five locations will be sampled in deep water (greater than 60 feet). These locations will represent average background concentrations in the lake.

Transects

Three areas will be sampled as perpendicular transects from the shoreline to deep water, using an additional four samples to supplement some of the nearshore and deepwater locations. The transect samples will ensure that PCB concentrations are characterized in surface sediments across different depths and contours of the lake. One transect will be located to the northwest of

Seward Park and the other two transects will be located at the south end near the Boeing Renton Facility and DNR property.

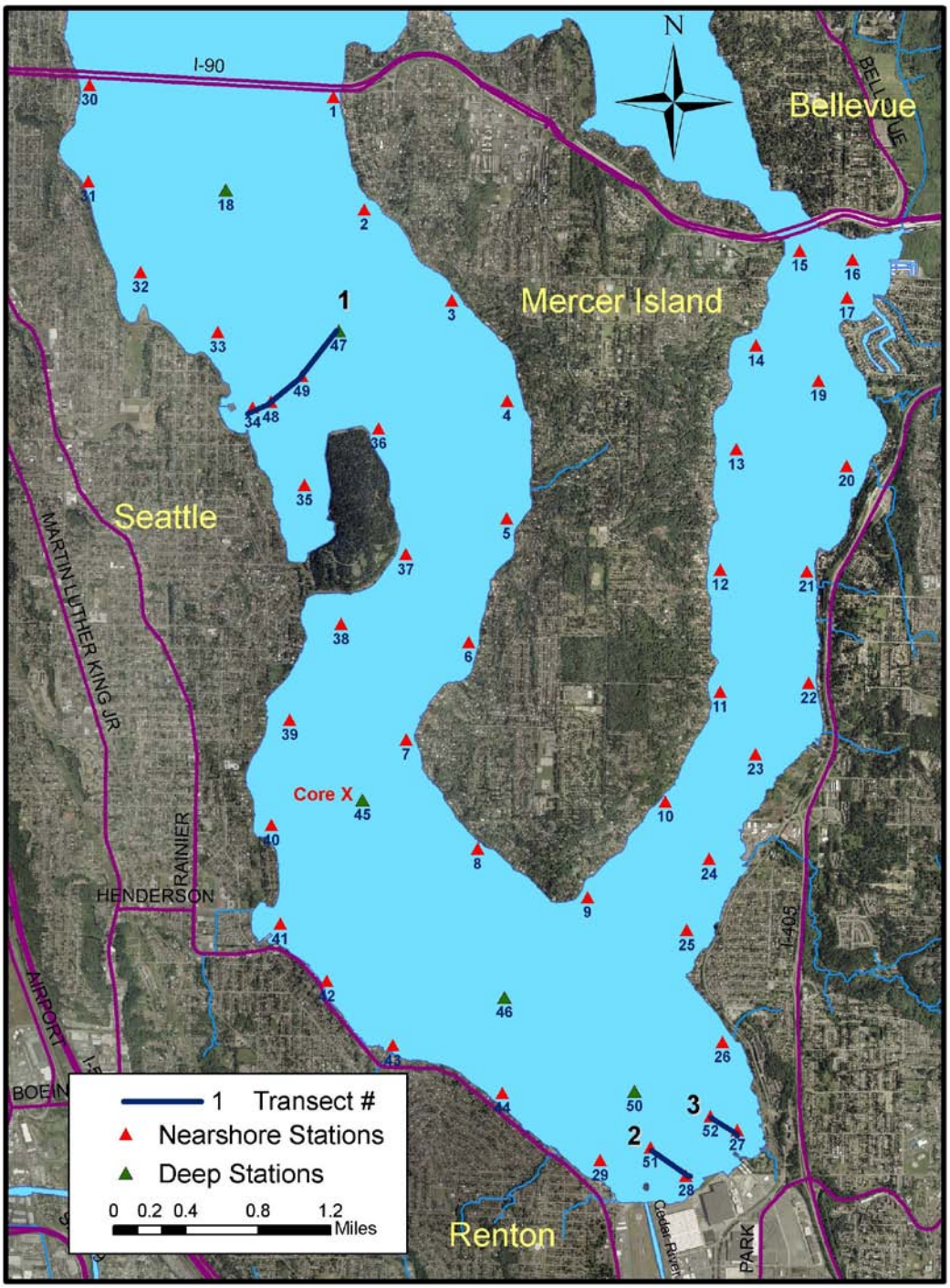

Figure 4. Sediment Sampling Stations and Transects.

Sediment Core

The sediment core for the current project was collected in August 2008, in collaboration with another ongoing Ecology study: *Depositional History of Mercury in Selected Washington Lakes Determined from Sediment Cores* (Coots, 2006). The location for the sediment core was representative of average background PCB concentrations in south Lake Washington (Figure 4). It was located in a relatively deep, flat-bottom area away from known sources of PCBs and sediment deposition.

Analyzing discrete sediment horizons from the sediment core will show the history of PCB deposition in Lake Washington. Trend lines from these data, coupled with other information, may be used to predict future concentrations in sediment deposits over time.

One centimeter horizons from the Lake Washington core are currently frozen awaiting analysis (the holding time for PCB analysis is up to 1 year, if frozen). Sediments will be analyzed for all 209 PCB congeners and TOC. For dating purposes, samples will be analyzed for lead ^{210} and total lead.

Sediment cores will be dated using both radioisotope lead ^{210} and stable lead methods as described in Coots, 2006. These methods have been successfully used in several recent Ecology studies.

Sampling Procedures

Surface Sediments

Surface sediments will be collected from 52 sites in late February and March 2009 in south Lake Washington using Ecology's 26-foot research vessel, the research vessel (RV) *Skookum*. To the extent possible, surface sediment sampling methods will follow Ecology's standard operating procedure (SOP) for obtaining freshwater sediment samples (Blakley, 2008). Sediments will be taken using either a standard Ponar ® or Van Veen grab sampler.

Surface sediment samples will be a composite of three grabs from each site. Differentially corrected Global Positioning System coordinates will be collected for each grab. The vessel will try to stay onsite for each grab so the total collection area for each site will remain small, preferably within a 10 meter circle.

Following collection of each sediment grab, an evaluation of acceptability will be made. Information about each sediment grab will be recorded in the field log (Table A-2). A grab will be considered acceptable if it is not overfilled, overlaying water is present but is not overly turbid, the sediment surface appears intact, and the grab reached the desired sediment depth.

Overlying water will be siphoned off prior to sub-sampling. Equal volumes of the top 2 centimeter of sediment will be removed from each of the three separate grabs per composite. Stainless steel spoons and bowls will be used for sub-sampling and to homogenize sediments from each station to a uniform consistency and color. Debris on the sediment surface, or materials contacting the sides of the grab sampler, will not be retained for analysis.

All equipment used to collect surface sediments will be pre-cleaned using the procedure described in the *Decontamination Procedures* section of this QA Project Plan. To avoid cross-contamination between sample sites, the grab sampler will be thoroughly brushed down with on-site water prior to the next sample location.

Surface sediment samples will be placed in coolers on ice immediately following collection and transported to Ecology's Manchester Environmental Laboratory. Surface sediments will be analyzed for PCB Aroclors, TOC, and grain size. Requirements for containers, preservation, and holding times are listed in Table 4. The chain-of-custody will be maintained throughout the sampling and analysis process.

Table 4. Recommended Containers, Preservations, and Holding Times.[1]

Analyte	Container	Preservation	Holding Time
Surface Sediments			
PCB Aroclors	Certified 4 oz glass jar Teflon lid liner	Refrigerate, 4° C	14 day Extraction 40 day Analysis (1 year if frozen)
TOC	2 oz glass jar Teflon lid liner	Refrigerate, 4° C	14 days (6 months if frozen)
Grain Size [2]	8 oz polyethylene jar	Refrigerate, 4° C	6 months
Core Sediments			
PCB Congeners	Certified 4 oz glass jar Teflon lid liner	Refrigerate, 4° C	14 day Extraction 40 day Analysis (1 year if frozen)
TOC	2 oz glass jar Teflon lid liner	Refrigerate, 4° C	14 days (6 months if frozen)
Total Lead	Certified 2 oz glass jar Teflon lid liner	Refrigerate, 4° C	6 months (2 years if frozen)
$Lead^{210}$	Polystyrene	Refrigerate, 4° C	N/A

[1] = Information taken from the Manchester Laboratory Manual (MEL, 2005).
[2] = Gravel, sand, silt, and clay fractions.
N/A = not applicable.
oz = ounce.
C = Centigrade.
PCB = polychlorinated biphenyls.
TOC = total organic carbon.

Sediment Core

The sediment core was collected in August 2008. Sampling methods followed Ecology's SOP for collection of freshwater sediment core samples (Furl and Meredith, 2008). The core was taken using a Wildco stainless steel box corer fitted with a 13 centimeter x 13 centimeter x 50 centimeter acrylic liner. The core reached approximately 37 centimeter and looked intact. Thirty-seven centimeter was the deepest core depth Ecology could achieve in the sampling area. This depth should be adequate based on previous Ecology studies, where adequate depths ranged from 25 to 45 centimeter (Norton, 2004; Coots and Era-Miller, 2005).

After retrieving the core, overlying water was carefully siphoned off and the acrylic liner removed from the corer. The sediment-filled liner was placed on an extruder table outfitted with a gear-driven piston to push sediments up and out of the liner. Sediment horizons were sliced with thin aluminum plates to a uniform thickness of 1 centimeter. Each sample layer was

transferred to an 8-ounce glass jar, placed in plastic bags on ice, and stored in coolers on ice. The samples were then transferred to freezers at Ecology and later processed for analysis.

Sediment age will be estimated by analyzing layers for the radioisotope lead^{210} and total lead (Yake, 2001). Sub-samples will be selected for analysis that represent (1) recent conditions (top centimeter layer), (2) background conditions which are used to calibrate the lead^{210} dating (bottom layer), and (3) a more concentrated selection of layers in the upper core, with wider spacing between layers moving down through the core. Layers not selected for chemical analysis will be archived frozen for possible analysis later.

Each sediment horizon selected for analysis will be homogenized prior to dividing for analysis. Homogenized sediments will be split into sub-samples for analysis of PCB congeners and TOC, and total lead and lead^{210} for dating. Requirements for containers, preservation, and holding times are listed in Table 4. Samples not immediately analyzed will be kept frozen at Ecology headquarters frozen under chain-of-custody procedures.

Decontamination Procedures

Decontamination procedures are described in depth in both the SOP for surface sediment collection and the SOP for sediment cores (Blakley, 2008; Furl and Meredith, 2008). Precautions will be taken to minimize contamination during both sample collection and processing. Persons collecting and preparing samples will wear non-talc nitrile gloves.

Utensils used in collection and manipulation of sediment samples will be washed thoroughly with tap water and Liquinox detergent, followed by sequential rinses of hot tap water, de-ionized water, acetone and hexane. Equipment will then be air dried and wrapped in aluminum foil until used in the field. The same cleaning procedure will be used on the grab sampler and box corer prior to going into the field.

Due to the large number of samples, some of the collection utensils may need to be cleaned in the field in order to re-use them for sample collection. In this case, utensils will be washed with onsite water and Liquinox detergent, followed by de-ionized water, acetone, and hexane.

Measurement Procedures

Laboratory reporting limits and analytical methods for the project are shown in Table 5. Laboratory costs are shown in Table 6.

Table 5. Laboratory Reporting Limits and Analytical Methods.

Analysis	Expected Range of Results	Laboratory Reporting Limits	Sample Preparation Method	Analytical Method
Surface Sediments				
PCB Aroclors	<5 - 1,000 ug/Kg	5 ug/Kg	EPA 3541	EPA 8082
TOC	<1 - 30%	0.1%	PSEP, 1986	PSEP, 1986
Grain Size	1% - 100%	0.1%	PSEP, 1986	PSEP, 1986
Core Sediments				
PCB Congeners	<5 - 500 ug/Kg	2 ug/Kg	EPA 1668A	EPA 1668A
TOC	<1 - 30%	0.1%	PSEP, 1986	PSEP, 1986
Total Lead	2-500 mg/Kg dry	2 mg/Kg dry	EPA 200.8	EPA 200.8
$Lead^{210}$	1.0-15.0 dpm*/g	1 dpm/g	EPA 901.1	EPA 901.1

*dpm = disintegrations per minute.
PCB = polychlorinated biphenyls.
TOC = total organic carbon.
Kg = kilograms.
mg = milligrams.
ug = micrograms.
PSEP = Puget Sound Estuary Program.
EPA = U.S. Environmental Protection Agency.

Table 6. Estimated Laboratory Costs[1].

Analysis	No. Samples	Field Duplicate Samples	Total No. Samples	Price per Unit	Total Price
Surface Sediments					
PCB Aroclors	52	3	55	$ 160	$ 8,800
TOC	52	3	55	$ 42	$ 2,310
Grain Size	52	3	55	$ 90	$ 6,188[2]
Core Sediments					
PCB Congeners	12	1	13	$ 900	$ 14,625[2]
TOC	12	1	13	$ 42	$ 546
Total Lead	10	1	11	$ --	$ --[3]
$Lead^{210}$	10	1	11	$ --	$ --[3]
				Total Laboratory Cost:	$ 32,469

1 = Costs include 50% discount for MEL analyses.
2 = Includes 25% surcharge for contracting services provided by MEL.
3 = Cost for total lead and $lead^{210}$ analyses will be covered by the mercury sediment core study (Coots, 2006).

Quality Control Procedures

Field

The field sampling and decontamination procedures described in the *Sampling Procedures* section on this QA Project Plan will be carefully followed to avoid contamination of samples. A copy of the QA Project Plan will be taken into the field for reference.

Natural variability in PCB concentrations in surface sediment samples will be addressed by analyzing samples as composites of three individual grabs at each site. Three of the composite surface samples will also be split and analyzed separately as field duplicates (Table 7). One of the horizons from the sediment core sample will also be split and analyzed as a duplicate. Field duplicate samples will be submitted blindly to the laboratories.

Table 7. Field Duplicate Samples.

Parameters	Field Duplicate/Split
PCB Aroclors	3/project
PCB Congeners	1/project
TOC	4/project
Grain Size	3/project

PCB = polychlorinated biphenyls.
TOC = total organic carbon.

Laboratory

The laboratory quality control procedures routinely followed by MEL and the contract laboratories will be satisfactory for the purposes of this project. Laboratory quality control samples are shown in Table 8.

Table 8. Laboratory Quality Control Samples.

Parameters	Method Blank	Lab Duplicate	Check Std./LCS	Surrogate Spikes
PCB Aroclors	1/batch*	1/batch	1/batch	All samples
PCB Congeners	1/batch	1/batch	1/batch	All samples
TOC	1/batch	1/batch	1/batch	--
Grain Size	--	3/project	--	--

* A batch is defined by MEL as 20 or fewer samples.
PCB = polychlorinated biphenyls.
TOC = total organic carbon.

As an indication of bias due to sample preparation, laboratory control samples (LCS) which contain a known amount of the analyte will be analyzed. Analytical precision will be estimated by analysis of laboratory duplicates.

Data Management Procedures

Field data will be recorded on hardcopy data sheets and then carefully transferred to electronic data sheets.

The data package from MEL and the contract laboratories will include case narratives discussing any problems encountered in the analysis, corrective actions taken, and an explanation of data qualifiers. The project manager will then review the data packages to determine if project MQOs (method blanks, LCS samples, surrogate compounds, matrix spikes, and laboratory duplicates) were met.

Data for the study will be entered into Ecology's Environmental Information Management System (EIM). Data entered into EIM follow a formal data review process where data is reviewed by the project manager of the study, the person entering the data, and an independent reviewer.

Audits and Reports

MEL participates in performance and system audits of their routine procedures. Results of these audits are available on request.

The Ecology draft technical report will be provided to the clients, internal Ecology reviewers, external reviewers, and other interested parties by November 2009. The final technical report will be completed and published by December 2009. The data will also be completed in EIM by December 2009.

The final technical report will include the following elements:

- Information about the sampling locations, including geographic coordinates and maps.
- Physical information about the samples.
- Descriptions of field and laboratory methods.
- Tables presenting all the chemistry data.
- Discussion of project data quality.
- Summary of significant findings.
- Recommendations for future follow-up work.

Data Verification

The project manager will review MEL's data packages and data verification reports. Based on these assessments, the data will either be accepted, accepted with appropriate qualifications, or rejected and re-analysis considered.

To determine if project MQOs have been met, the project manager will compare results of the field and laboratory QC samples to MQOs. To evaluate whether the targets for reporting limits have been met, the results will be examined for non-detects to determine if any values exceed the lowest concentration of interest.

Formal (third party) validation of the data will not be necessary for this project.

Data Quality (Usability) Assessment

Once the data have been reviewed and verified, the project manager will determine if the quality and quantity of the data are useable for the purposes of the study. The project manager will review laboratory data by determining if study MQOs were met.

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Appendix. Sampling Information

Table A-1. Sampling Site Coordinates for the South Lake Washington Sediment PCB Study.

Location ID	Latitude	Longitude		Location ID	Latitude	Longitude
WA-1	47.588653	-122.255223		WA-27	47.506500	-122.205256
WA-2	47.579687	-122.251337		WA-28	47.502777	-122.211203
WA-3	47.572540	-122.240768		WA-29	47.503890	-122.221369
WA-4	47.564561	-122.234017		WA-30	47.589244	-122.284132
WA-5	47.555145	-122.233791		WA-31	47.581513	-122.284098
WA-6	47.545193	-122.238055		WA-32	47.574324	-122.277686
WA-7	47.537291	-122.245204		WA-33	47.569655	-122.268426
WA-8	47.528649	-122.236547		WA-34	47.563652	-122.264109
WA-9	47.524927	-122.223453		WA-35	47.557524	-122.257834
WA-10	47.532707	-122.214431		WA-36	47.562169	-122.249171
WA-11	47.541580	-122.208153		WA-37	47.552122	-122.245689
WA-12	47.551356	-122.208411		WA-38	47.546448	-122.253184
WA-13	47.561011	-122.206754		WA-39	47.538694	-122.259067
WA-14	47.569355	-122.204657		WA-40	47.530237	-122.260986
WA-15	47.577025	-122.199667		WA-41	47.522352	-122.259725
WA-16	47.576366	-122.193445		WA-42	47.517837	-122.254096
WA-17	47.573309	-122.193984		WA-43	47.512780	-122.246115
WA-18	47.581025	-122.267760		WA-44	47.509128	-122.233110
WA-19	47.566622	-122.197211		WA-45	47.532411	-122.250288
WA-20	47.559832	-122.193701		WA-46	47.516799	-122.233031
WA-21	47.551336	-122.198169		WA-47	47.569944	-122.254099
WA-22	47.542405	-122.197706		WA-48	47.564137	-122.261979
WA-23	47.536618	-122.203840		WA-49	47.566249	-122.258392
WA-24	47.528159	-122.209135		WA-50	47.509472	-122.217464
WA-25	47.522444	-122.211644		WA-51	47.504976	-122.215447
WA-26	47.513528	-122.207190		WA-52	47.507572	-122.208441

Table A-2. Ecology Field Log for Sediment Collection.

Station ID	Grab #	Date	Time	Latitude	Longitude	Water Depth (m)	Penetration Depth (cm)	Description
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							
	1							
	2							
	3							