

MEMORANDUM

DATE: January 21, 2009

TO: Recipients

FROM: Scott Mickelson, Kimberle Stark, and Debra Williston

SUBJ: Final 2009 Work Plan
Marine and Sediment Assessment Group
Marine Monitoring Programs and Projects

This memorandum and attachments summarize the 2009 Work Plan for the Marine and Sediment Assessment Group. The work plan includes both routine marine monitoring programs and Wastewater Treatment Division capital support projects such as the Brightwater marine outfall, Sediment Management Plan, and East Waterway and Lower Duwamish Waterway Superfund projects. Included with the memorandum are matrix tables that provide sampling locations, sampling frequency, and parameters measured for the 2009 routine monitoring programs, as well as maps showing sampling locations.

Station locations and analytical parameters may change from year to year. Changes may be based on an evaluation of previous years' data to determine if the data collected are meeting monitoring objectives for both the ambient and outfall monitoring programs and/or budgetary constraints. Marine and Sediment Assessment Group staff evaluate data each year to determine what changes are necessary, including what parameters should continue to be analyzed.

Also included with this memorandum is a record of how the marine monitoring program has changed over time, both in locations sampled and water quality constituents monitored.

2009 Marine Offshore Water Column Monitoring Program

Water column samples will be collected monthly from 18 stations. Nine outfall monitoring stations are located at outfalls for the West Point, South, and Vashon treatment plants, the Alki and Carkeek combined sewer overflow (CSO) treatment plants, the Elliott West and Henderson/MLK/Norfolk CSO treatment facilities, and the Hanford/Lander and Barton CSOs. Seven ambient monitoring stations are located at Point Wells, Point Jefferson, Elliott Bay, Fauntleroy/Vashon, East Passage, and inner and outer Quartermaster Harbor. Water samples will be collected from between one and seven depths at each offshore station, depending on the total station depth. Two additional ambient stations, collected as part of the marine offshore sampling run, are located in the Duwamish River, just upstream of Harbor Island and at the 16th Avenue South bridge, with samples collected from two depths at each station.

Laboratory analytes will include fecal coliform and enterococcus bacteria, chlorophyll-*a* and pheophytin pigments, solids, and nutrients (ammonia, nitrite/nitrate nitrogen, total Kjeldahl nitrogen, total phosphorus, and silica). Bacteria samples will be collected from all sampling depths at each of the outfall monitoring stations but only from the surface at ambient monitoring

stations, with the exception of the Quartermaster Harbor and Duwamish River samples. Bacteria samples will be collected from both depths at each Quartermaster Harbor and Duwamish River ambient station. All other laboratory parameters will be analyzed on samples collected from every depth. Electronic *in situ* data will be collected at each station (except the two Quartermaster Harbor stations) using a CTD (conductivity/temperature/depth) sensor array and include the following parameters; dissolved oxygen, salinity, temperature, density (calculated), transmissivity, photosynthetically active radiation, and fluorescence (as a measure of chlorophyll).

A second instrument, the LISST (Laser In-Situ Scattering and Transmissometry), will also be employed during the offshore monitoring at the two Duwamish River stations as well as the Elliott Bay ambient station. This instrument is a multi-parameter system for *in situ* observations of particle size distribution. It also records optical transmission, pressure and temperature. LISST data are being collected at the request of WTD staff for computer modeling purposes. Field measurements at the two Quartermaster Harbor stations will be collected with a YSI[®] sonde and will include temperature and dissolved oxygen.

The two Duwamish River stations and the Hanford/Lander CSO station are sampled for the purpose of collecting water quality data essential to King County's modeling efforts for the Lower Duwamish Waterway Superfund project, the East Waterway Superfund project, Sediment Management Plan, and CSO Control programs. Additional parameters collected at these stations include total and dissolved organic carbon and three fractions of solids.

2009 Marine Beach Water Quality Monitoring Program

Water samples will be collected monthly from 28 beach stations and 1 stream station. Five outfall-vicinity beach monitoring stations are located onshore of the Alki (1 station), West Point (2 stations), Carkeek (1 station), and Vashon (1 station) outfalls. All five of the outfall-vicinity monitoring stations will be sampled monthly for analysis of fecal coliform and enterococcus bacteria, temperature, salinity, and nutrients (ammonia, nitrite/nitrate nitrogen, and total phosphorus). All 23 of the ambient beach stations will also be monitored for bacteria, temperature, nutrients, and salinity. The Piper's Creek stream station will be monitored for bacteria, temperature, and nutrients.

2009 Shellfish Monitoring Program

Shellfish tissue samples will be collected twice in 2009, in March and August, from nine intertidal monitoring stations. Five outfall-vicinity monitoring stations will be located inshore of the West Point (two stations) and Vashon treatment plant outfalls and the Alki and Carkeek CSO treatment plant outfalls. Four ambient shellfish monitoring stations will be located at Edwards Point, Point Wells, Golden Gardens Park, and Normandy Park.

Analytes will include trace metals, percent solids, percent lipids, and polybrominated diphenyl ethers (PBDEs). PBDEs were added to the shellfish suite of analytes in 2008 due to their high detection rate in sediments and their status as an emerging chemical of concern in Puget Sound with potential bioaccumulative properties. Analysis of PBDEs in shellfish tissue provided a useful data set and this analysis will be continued in 2009.

2009 Subtidal Sediment Monitoring Program

King County restructured its ambient marine subtidal sediment monitoring program in 2007 to both supplement and support the Washington State Department of Ecology's sediment monitoring program and to provide focused monitoring of sediment quality in Elliott Bay. Subtidal sediments will be collected every two years from eight stations in Elliott Bay and every five years from six additional stations outside of Elliott Bay, including three stations in the main basin of Puget Sound and three associated embayments. All 14 stations were first sampled in 2007.

In 2009, the eight Elliott Bay stations will be sampled. Sediment samples will be analyzed for conventional parameters (total solids, total organic carbon, particle size distribution, ammonia, sulfides), metals, and organics (semivolatile compounds, chlorinated pesticides, PCBs, and PDBEs (flame retardants)). An updated sampling and analysis plan will be created for the 2009 sampling event. Data generated from the ambient subtidal sediment monitoring program are used, in part, to provide information for the County's KingStat environmental indicators program.

Brightwater Marine Outfall Monitoring and Technical Support

Brightwater project work during 2009 will include:

- preparation of an eelgrass propagation memorandum for delivery to regulatory agencies;
- finalization of contracting activities and issuance of the eelgrass transplant and monitoring contract;
- preparation of revised eelgrass restoration and biological resources work plan;
- consultant oversight and coordination for eelgrass transplanting and survey activities;
- preparation of a report on the 2006 and 2007 nearshore benthic characterization;
- conducting the first post-construction intertidal biota survey at the outfall site;
- preparation of a technical memorandum on the pre-construction intertidal biota;
- conducting the first post-construction nearshore benthic survey;
- preparation of a technical memorandum on the pre-construction nearshore benthic surveys; and
- support for agency and public meetings.

Denny Way/Lake Union CSO Control Project Sediment Monitoring Program

On-going sediment monitoring at this project site is being performed in accordance with the Biological Opinion issued for the project under the Endangered Species Act Section 7 consultation. The new Elliott West CSO treatment facility (TF) came on-line in May 2005. The fourth post-operation sediment monitoring event will occur in April 2009 at the Elliott West TF and Denny Way CSO outfalls and will involve the collection of surface sediment samples from 16 stations. Samples will be analyzed for sediment chemistry (16 stations) and benthic infauna (8 stations). One of the 16 stations collected also provides support for post-construction monitoring for the Areas A & B nearshore interim sediment cleanup project. An updated sampling and analysis plan will be created for the 2009 sediment sampling event. Three reports will be finalized in 2009 – the 2006, 2007, and 2008 annual monitoring reports.

East Waterway Superfund Project

King County is a participant in the East Waterway Group (EWG), which also includes the City of Seattle and the Port of Seattle. Our group provides technical and project management support on behalf of King County WTD. Support includes project scoping, analysis and review of consultant work products, and representing KC during project team meetings and agency and stakeholder meetings. Specific King County activities for 2009 will include:

- monthly EWG and EPA project meetings;
- analysis, review and comment on reports (EPA submittal dates follow);
 1. Quality Assurance Project Plans (drafts in winter/spring 2009)
 2. Data Reports (various drafts in spring/summer 2009)
 3. Human Access Survey Memo (draft winter 2009)
 4. Risk Assessment Tech Memos (drafts winter 2008/2009)
 5. Source Control Conceptual Site Model/Data Gaps Memo (draft winter 2009)
 6. Human Health and Ecological Risk Assessments (drafts winter 2010)
- analysis, review and comment on agency comments various draft reports; and
- support of source control activities.

Lower Duwamish Waterway Superfund Project

King County is a participant in the Lower Duwamish Waterway Group (LDWG), which also includes the City of Seattle, the Port of Seattle, and The Boeing Company. Our group provides technical and project management support on behalf of King County WTD. Support includes project scoping, analysis and review of consultant work products, and representing KC during project team meetings and agency and stakeholder meetings. Specific King County LDWG activities for 2009 will include:

- weekly LDWG project meetings;
- various LDWG/agency project meetings (including scoping/reviewing material for these meetings);
- quarterly stakeholder meetings;
- analysis, review and comment on agency comments subsequent revised remedial investigation report (final expected in spring 2009);
- analysis, review and comment on various feasibility study (FS) components and draft text (draft submitted March 2009);
- analysis, review and comment on agency comments draft FS;
- general support of source control activities and project management as needed; and
- Green River 2007/08 PCB and PAH Water Data Memo (spring 2009).

West Point NPDES Permit-Related Work

West Point NPDES permit-related work in 2009 will include:

- preparation of an outfall water column monitoring SAP;
- preparation of a CSO water column monitoring SAP;
- preparation of a technical memorandum on benthic sampling at West Point outfall; and
- research, data analysis, and preparation of report sections on CSO sediment quality.

Marine Moorings

Marine moorings that include *in situ* water quality data gathering sensors are currently deployed at two locations – the Seattle Aquarium (two depths) and Dockton Park (one depth). One additional marine mooring (two depths), deployed from a buoy in outer Quartermaster Harbor, will support data gathering efforts for the EPA grant-funded Quartermaster Harbor Nitrogen Loading Study. An additional system may be deployed in the north Puget Sound Central Basin dependent upon funding and logistical issues.

These marine mooring systems gather data for dissolved oxygen, salinity, temperature, chlorophyll, turbidity, pH, and meteorological parameters. The mooring system deployed at the surface in outer Quartermaster Harbor will also gather data on nitrate nitrogen. Continuous data gathering will involve a high degree of data management, QC, and website maintenance to make the data available publicly. If the fourth mooring system is deployed, there will be additional work involving the permitting of the deployment.

Miscellaneous 2009 Work Items

- Phytoplankton sampling (along with water quality parameters) at three existing marine water column stations, twice a month from April through September.
- Completion of the final 2005/2006/2007 Marine Monitoring report.
- Completion of the final 2008 Marine Monitoring report.
- Performance measure and environmental indicator update and development.
- Preparation of sections for the RWSP Update report.
- Preparation of a poster for and participation in the 2009 Puget Sound/Georgia Basin Ecosystem Conference.
- Preparation of a poster for and participation (as a session chair) in the 2009 Coastal Estuarine Research Federation Biennial Meeting.
- Sediment Management Plan technical support.
- LDW/EW-related work; management of CSO data collection activities and data memoranda.
- Annual 2010 marine monitoring work plan.
- Technical support for the Puget Sound Partnership.
- Updating and maintenance of the Marine and Sediment Assessment Group web page.
- Technical assistance for NPDES permit negotiations for the South Treatment Plant and Brightwater Treatment Facility.
- Support for preparation of the 2008 Duwamish/Diagonal Sediment Remediation monitoring report.

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How the Routine Marine Monitoring Program Has Changed Over Time

The table at the end of this section provides a 10-year summary of the number of stations sampled for the routine and NPDES marine monitoring programs between 2000 and 2009. Various changes to stations and parameters have occurred based upon evaluation of previous years' data. Brief descriptions of program changes since 1998, when the program underwent major revisions, are included below.

In 1998, the marine monitoring program underwent major refinements based upon evaluation of previous years' data. Only butter clams were collected for shellfish samples; prior to 1998,

shellfish of any species were collected and composited into a single sample which did not allow for trend analysis. Additional changes to shellfish program in 1998 included recording shell lengths and developing a range of acceptable sizes and a minimum number of clams to be composited. A beach station at Normandy Park was added to provide additional coverage in the southern portion of King County. An additional station transect was added to the West Point NPDES outfall sediment sampling program so that one transect is now located at the end of the pipe and another at the mid-diffuser point. Benthic infauna were collected at five transect stations and a reference station, rather than at a single station at the end of the pipe, which was the practice prior to 1998. Bacteria was deleted from the list of parameters for sediments as this was not deemed useful to the program objectives.

In 1999, an additional transect was added to the South Plant NPDES outfall sediment sampling program so that one transect is now located at the end of the pipe and another at the mid-diffuser point. Benthic infauna were collected at five transect stations and a reference station. A total of 18 sediment samples were collected from the Vashon treatment plant outfall for baseline characterization after the County took over operation of this treatment facility. Metals were sampled in beach waters based upon elevated levels of metals found in algae data from 1998. An ambient beach station in Kitsap County (Port Madison) was added as an algae reference station.

In 2000, the Port Madison station was deleted after discovering an outfall pipe close to the sampling station. Nutrients were added at some beach stations. Bacteria were only analyzed at surface depths for offshore stations, with the exception of outfall stations where bacteria continued to be collected from multiple sampling depths. Dissolved metals were only analyzed in beach waters and total metals were deleted.

In 2001, two water stations were deleted from the sampling program as they were not providing further useful information. A beach station was added near the Vashon treatment plant for the outfall monitoring program.

In 2002, the program remained similar to 2001 with the exception that one of the beach stations at Richmond Beach was deleted from the sampling program as it was not providing further useful information.

In 2003, one ambient water-column monitoring station in south Puget Sound was added to the offshore program, one ambient water-column station located in the Lake Washington Ship Canal was removed from the offshore program, several beach stations that were previously monitored as part of the Marine Outfall Siting Study were removed from the beach program, one bacteria monitoring station was removed from the shellfish program, and nutrient sampling was added to three beach water monitoring stations.

In 2004, the monthly (May through September) shellfish bacteria monitoring program was discontinued due to a lack of applicable criteria to which shellfish tissue could be compared. Fecal coliform data from water samples are used to assess environmental health in shellfish growing areas for the State of Washington. Three beach stations that had previously been sampled for bacteria concentrations in beach water from May through October only were changed to year-round monthly sampling. One new beach monitoring station was added at Salt Water State Park in south King County for collection of bacteria water samples only.

In 2005, three monthly beach water sampling stations were discontinued due to overlap with Ecology's BEACH program. Two Duwamish River water column stations were transferred from the monthly beach water sampling run to the monthly offshore water column sampling run and additional parameters were added to these stations to meet the needs of modeling efforts for the LDWG program. Offshore water column monitoring stations at Vashon and Denny were relocated to reflect new outfall locations. The ambient offshore station at Point Wells was relocated to reflect the future location of the Brightwater outfall.

In 2006, the routine marine monitoring program again underwent major changes. The annual intertidal sediment and algae monitoring programs were discontinued. The shellfish monitoring program was increased in frequency from annually to semiannually, two new stations were added, and trace organics were discontinued from the suite of analytes. Salinity and nutrients were added to the suite of analytes for all beach monitoring stations.

In 2007, the marine monitoring program again underwent major changes. Two ambient stations, located in Salmon Bay and Fauntleroy Cove, were added to the monthly offshore water-column monitoring program. Thirteen stations were added to the monthly marine beaches water quality monitoring program, representing both ambient and outfall monitoring locations. All beach water quality monitoring stations are sampled for bacteria, nutrients, salinity, and temperature. The ambient subtidal sediment monitoring program was reinstated to now sample Elliott Bay sediments from eight stations biennially, and sediments from six other stations in the main basin and associated embayments every five years.

In 2008, there were only two minor changes to the marine monitoring program. Bacteria sampling was added at a second depth at station LSVV01, due to its proximity to the Barton Street CSO outfall as well as many other stormwater and freshwater inputs. The analysis of PBDEs was added to the semiannual shellfish tissue monitoring program on a one-year trial basis.

In 2009, there will again only be minor changes to the routine marine monitoring program. One ambient station has been discontinued from the offshore water column monitoring program. Station KSRU03, located in outer Salmon Bay on the marine side of the Hiram M. Chittenden locks, was monitored for two years. A review of the data indicated that there were sampling problems in collecting salinity and dissolved oxygen data, due to the strong pycnocline caused by the constant introduction of freshwater from the operation of the locks. A nearby beach station, KSQU01, will provide sufficient data for bacteria, nutrients, and salinity to be able to assess water quality in this area. One outfall station has been added to the offshore water column monitoring program. Station LTXQ01 will be located downstream of the Henderson/MLK/Norfolk CSO treatment facility outfall. Parameters monitored will include bacteria, total suspended solids, nutrients, salinity, dissolved oxygen, temperature, and hardness. The biennial sampling of subtidal sampling sediments will occur at eight stations in Elliott Bay. Total Kjeldahl Nitrogen (TKN) has been added as an analytical parameter at 13 water stations (15 samples). This parameter has been added to allow a calculation of the contribution of organic nitrogen to total nitrogen concentrations in marine waters.

Summary Table of Routine Marine Monitoring Stations over Time

Stations/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total Stations	51	51	39	34	43	38	51	54	47	55
Outfall Stations	29	30	12	12	12	16	31	13	17	18
Ambient Stations	22	21	27	22	31	22	20	41	30	37
Water Stations	34	32	33	34	37	34	33	45	46	47
Sediment Stations	31	25	13	5	11	8	18	13	0	8
Shellfish Stations	10	10	10	9	7	7	9	9	9	9
Algae Stations	8	8	10	8	8	7	0	0	0	0
Outfall Stations	29	30	12	12	12	16	31	13	17	18
Water Stations	12	11	12	12	12	12	13	13	16	18
Sediment Stations	22	22	4	4	4	4	18	0	0	0
Shellfish Stations	4	4	5	5	4	4	4	5	5	5
Algae Stations	4	4	5	5	5	4	0	0	0	0
Ambient Stations	22	21	27	22	31	22	20	41	30	37
Water Stations	22	21	21	22	25	22	20	32	30	29
Sediment Stations	9	3	9	1	7	4	0	13	0	8
Shellfish Stations	6	6	5	4	3	3	5	4	4	4
Algae Stations	4	4	5	3	3	3	0	0	0	0

Note: Algae sampling was discontinued after the 2005 sampling event.

**Marine and Sediment Assessment Program
2009 Ambient Stations, Laboratory Parameters, and Frequency Measured**

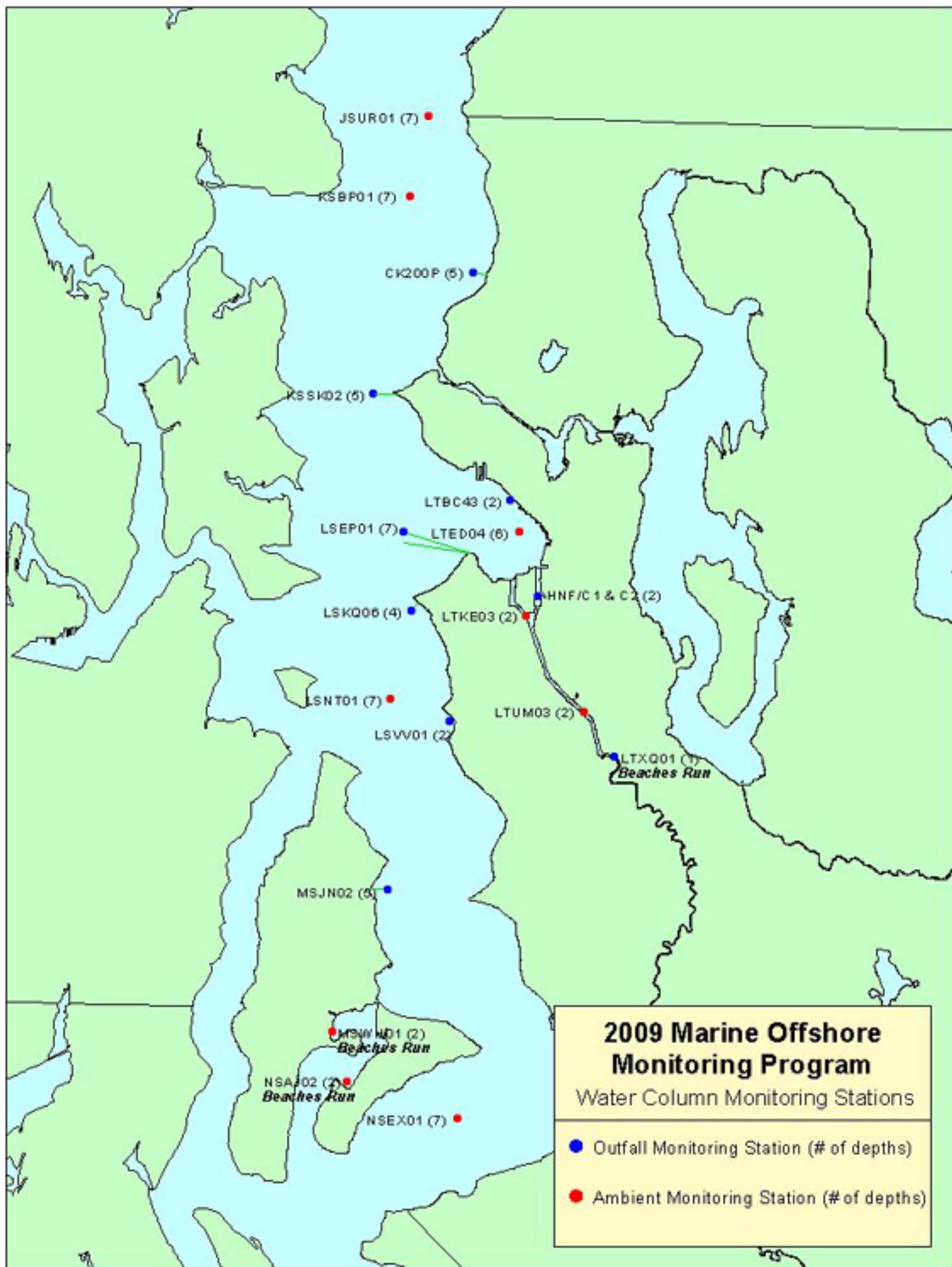
Station	Location	Stratum	Number of Depths for Water Samples	Water		Sediment			Shellfish			Budget Information		
				Bacteria ¹	Conventionals	Conventionals	Metals	Organics	Conventionals	Metals	Organics	Program	Customer	Funding Source
JSUR01	Brightwater	Offshore	7	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KSBP01	Jefferson Head	Offshore	7	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTKE03	Duwamish River	Offshore	2	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTUM03	Duwamish River	Offshore	2	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSNT01	Fauntleroy/Vashon	Offshore	7	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSEX01	East Passage	Offshore	7	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSWH01	Quartermaster Harbor	Offshore	2	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSAJ02	Quartermaster Harbor	Offshore	2	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTED04	Elliott Bay	Offshore	6	◆ 12	◆ 12	◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KSZY01	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTA02	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSCW02	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTCA02	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTDF01	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSHZ08	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTGF01	Elliott Bay	Offshore	--			◆ 1	◆ 1	◆ 1				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
ITEDWARDSPT	Edwards Point	Beach	1	◆ 12	◆ 12				◆ 2	◆ 2	◆ 2	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
JSVW04	Richmond Beach	Beach	1	◆ 12	◆ 12				◆ 2	◆ 2	◆ 2	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
ITCARKEEKP	Carkeek Park	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KTHA01	Piper's Creek	Stream	1	◆ 12	◆ 12							Ambient/PSAMP	WTD	WTD Operating
KSLU03	Golden Gardens	Beach	1	◆ 12	◆ 12				◆ 2	◆ 2	◆ 2	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KSQU01	Shilshole Bay	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Ecol.	WTD Operating
LTEH02	Inner Elliott Bay	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Ecol.	WTD Operating
LSGY01	Seacrest	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSHV01	Alki Beach	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSLT02	Me-Kwa-Mooks	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTTL02	Duwamish Park	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Ecol.	WTD Operating
MTEC01	Seahurst Park	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MTLD03	Normandy Park	Beach	1	◆ 12	◆ 12				◆ 2	◆ 2	◆ 2	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MTUJ01	Des Moines Pk.	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NTFK01	Redondo Beach	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSJY01	Dumas Bay	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MRUW01	Lisabuela Park	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSXK01	Burton Acres	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MTXA01	Point Robinson	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSSM05	Tramp Harbor	Beach	1	◆ 12	◆ 12							Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
Total Samples for 2008				396	744	8	8	8	8	8	8			
Total Samples on a Monthly Basis				33	62	8	8	8	4	4	4			

¹Bacteria samples collected only at the surface for offshore stations, with the exception of the two Duwamish River and two Quartermaster Harbor stations.

**Marine and Sediment Assessment Program
2009 Outfall Stations, Laboratory Parameters, and Frequency Measured**

Station	Location	Stratum	Number of Depths for Water Samples	Water			Sediment			Shellfish			Budget Information		
				Bacteria	Metals	Conventionals	Conventionals	Metals	Organics	Conventionals	Metals	Organics	Program	Customer	Funding Source
CK200P	Carkeek Outfall	Offshore	5	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSK02	West Point Outfall	Offshore	5	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTBC43	Denny Way Outfall	Offshore	2	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSEP01	Renton Outfall	Offshore	7	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKQ06	Alki Outfall	Offshore	4	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
MSJN02	Vashon Outfall	Offshore	5	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol./WaDNR	WTD Operating
LSVV01	Barton CSO Outfall	Offshore	2	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTXQ01	Hend/MLK/Nfk Outfall	Offshore	1	◆ 12	◆ 12	◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
HNF/C1&2	Hanford/Lander CSOs	Offshore	2	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSHZ03	Carkeek Park	Beach	1	◆ 12		◆ 12			◆ 2	◆ 2	◆ 2		Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSN04	West Point North	Beach	1	◆ 12		◆ 12			◆ 2	◆ 2	◆ 2		Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSN05	West Point South	Beach	1	◆ 12		◆ 12			◆ 2	◆ 2	◆ 2		Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSYV02	Magnolia CSO	Beach	1	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTBD27	Sculpture Park	Beach	1	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKR01	Alki North	Beach	1	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKS01	Richey Viewpoint	Beach	1	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKS04	Alki South	Beach	--						◆ 2	◆ 2	◆ 2		Outfall Mon.	WTD	WTD Operating
LSVW01	Fauntleroy Cove	Beach	1	◆ 12		◆ 12							Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
MSJL01	Vashon Island	Beach	1	◆ 12		◆ 12			◆ 2	◆ 2	◆ 2		Outfall Mon.	WTD/PSP/Kstat/Ecol./WaDNR	WTD Operating

Total Samples for 2008	504	12	504	0	0	0	10	10	10
Total Samples on a Monthly Basis	42	1	42				5	5	5



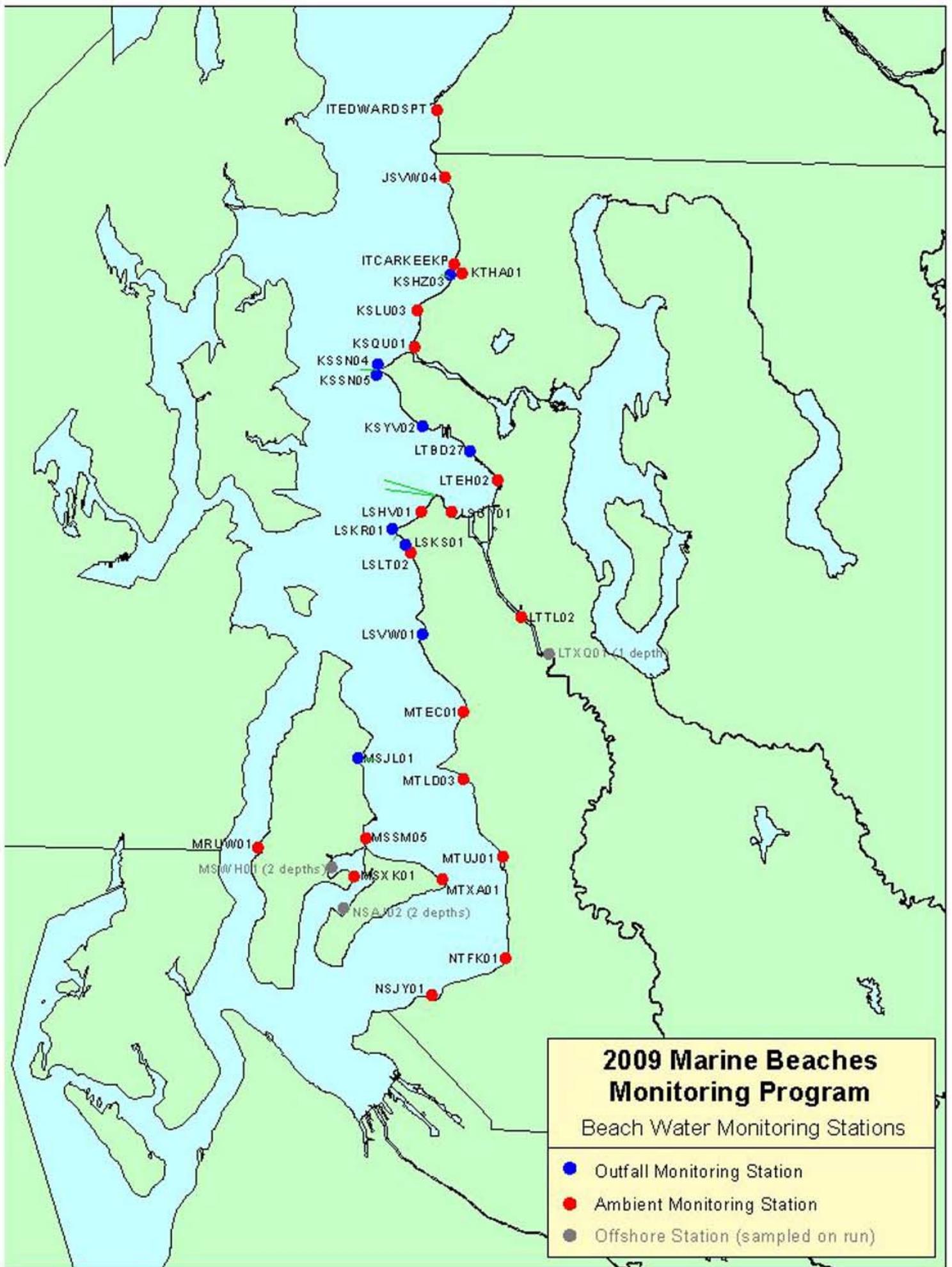
2009 Marine Beaches Monitoring Program
Monthly Ambient and Outfall Water Quality Sampling Run
Laboratory and Field Parameters

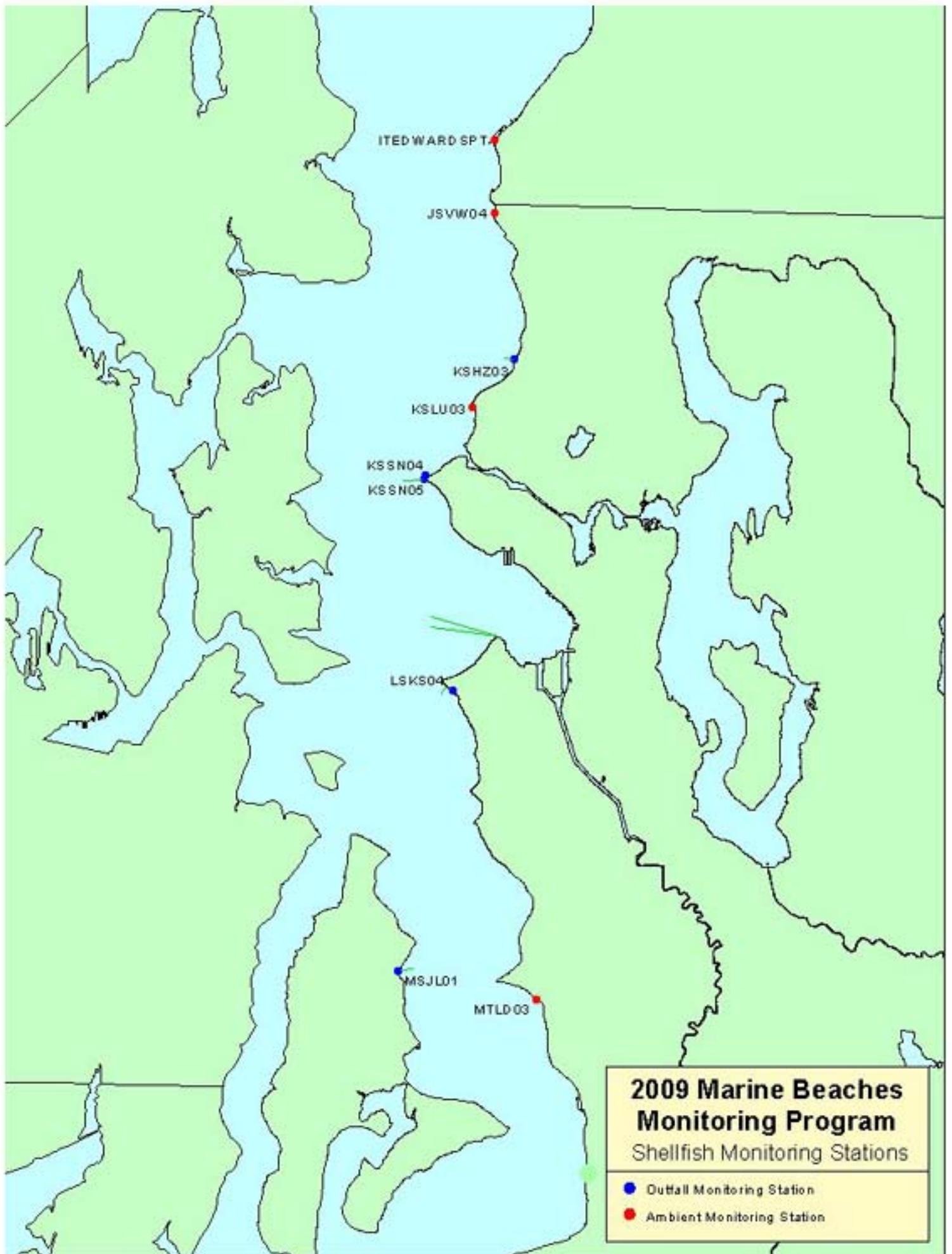
Locator	Station Description	Bacteria		Conventionals									Field				
		Enterococcus	Fecal Coliform	Ammonia Nitrogen	Chlorophyll-a	Hardness by ICP	Nitrite + Nitrate Nitrogen	Phaeophytin	Salinity	Silica	Total Kjeldahl Nitrogen	Total Phosphorus	Total Suspended Solids	Dissolved Oxygen, Field	Sample Start Time	Sampling Method	Sample Temperature, Field
ITEDWARDSPT	Edwards Point	1	1	1			1		1			1			1	1	1
JSVW04	Richmond Beach	1	1	1			1		1		1				1	1	1
ITCARKEEKP	Carkeek Park - North	1	1	1			1		1						1	1	1
KSHZ03	Carkeek Park - Piper's Creek Mouth	1	1	1			1		1		1				1	1	1
KTHA01	Carkeek Park - Piper's Creek Upstream	1	1	1			1								1	1	1
KSLU03	Golden Gardens	1	1	1			1		1						1	1	1
KSQU01	Shilshole Bay - Ray's Boathouse	1	1	1			1		1						1	1	1
KSSN04	West Point - North	1	1	1			1		1						1	1	1
KSSN05	West Point - South	1	1	1			1		1						1	1	1
KSYV02	Magnolia CSO	1	1	1			1		1						1	1	1
LTBD27	SAM Sculpture Park Beach	1	1	1			1		1						1	1	1
LTEH02	Elliott Bay - Pier 48	1	1	1			1		1						1	1	1
LSGY01	Seacrest Park	1	1	1			1		1						1	1	1
LSHV01	Alki Beach	1	1	1			1		1						1	1	1
LSKR01	Alki Beach - Alki Plant North	1	1	1			1		1						1	1	1
LSKS01	Richey Viewpoint	1	1	1			1		1						1	1	1
LSLT02	Me-Kwa-Mooks Park	1	1	1			1		1						1	1	1
LSVW01	Fauntleroy Cove	1	1	1			1		1		1				1	1	1
L TTL02	Duwamish Park	1	1	1			1		1						1	1	1
LTXQ01	Norfolk/Henderson/MLK CSO	1	1	1		1	1		1		1	1	1	1	1	1	1
MTEC01	Seahurst Park	1	1	1			1		1						1	1	1
MTLD03	Normandy Park	1	1	1			1		1						1	1	1
MTUJ01	Des Moines Creek Park	1	1	1			1		1						1	1	1
NTFK01	Redondo Beach	1	1	1			1		1		1				1	1	1
NSJY01	Dumas Bay Park	1	1	1			1		1		1				1	1	1
MRUW01	Vashon Island - Lisabela Park	1	1	1			1		1						1	1	1
MSJL01	Vashon Island - Gorsuch Road	1	1	1			1		1						1	1	1
MSSM05	Vashon Island - Tramp Harbor	1	1	1			1		1						1	1	1
MSXK01	Vashon Island - Burton Acres Park	1	1	1			1		1		1				1	1	1
MSWH01	Vashon Island - QMH Yacht Club	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2
MTXA01	Maury Island - Point Robinson Park	1	1	1			1		1						1	1	1
NSAJ02	Maury Island - Dockton Park Pier	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2
Total Samples/Records per Month		34	34	34	4	1	34	4	33	4	8	34	5	5	34	34	34

Notes

Stations MSWH01, NSAJ02, and LTXQ01 are part of the offshore program but are sampled on the beaches run for logistical purposes.

Changes/additions to the program for 2009 in red.





**2009 Marine Offshore Program
Ambient Subtidal Sediments
Laboratory and Field Parameters**

Locator	Station Description	Laboratory									Field							
		BNAs (incl. Total Nonylphenols)	Chlorinated Pest/PCBs	PBDES	Butyitin Isomers	Total Metals	Total Solids	Total Organic Carbon	PSD	Ammonia	Total Sulfide	Sample Start Time	Sample Depth	Sediment Sampling Depth	Sediment Sampling Range	SampcoordX	SampcoordY	Sediment Description
KSZY01	Elliott Bay - Pier 90/91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTAA02	Elliott Bay - Grain Terminal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LSCW02	Elliott Bay - Outer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTCA02	Elliott Bay - North Central	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTDF01	Elliott Bay - Central Waterfront	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTED04	Elliott Bay - South Central	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LSHZ08	Elliott Bay - Cove 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTGF01	Elliott Bay - Harbor Island	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Samples/Records		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Notes

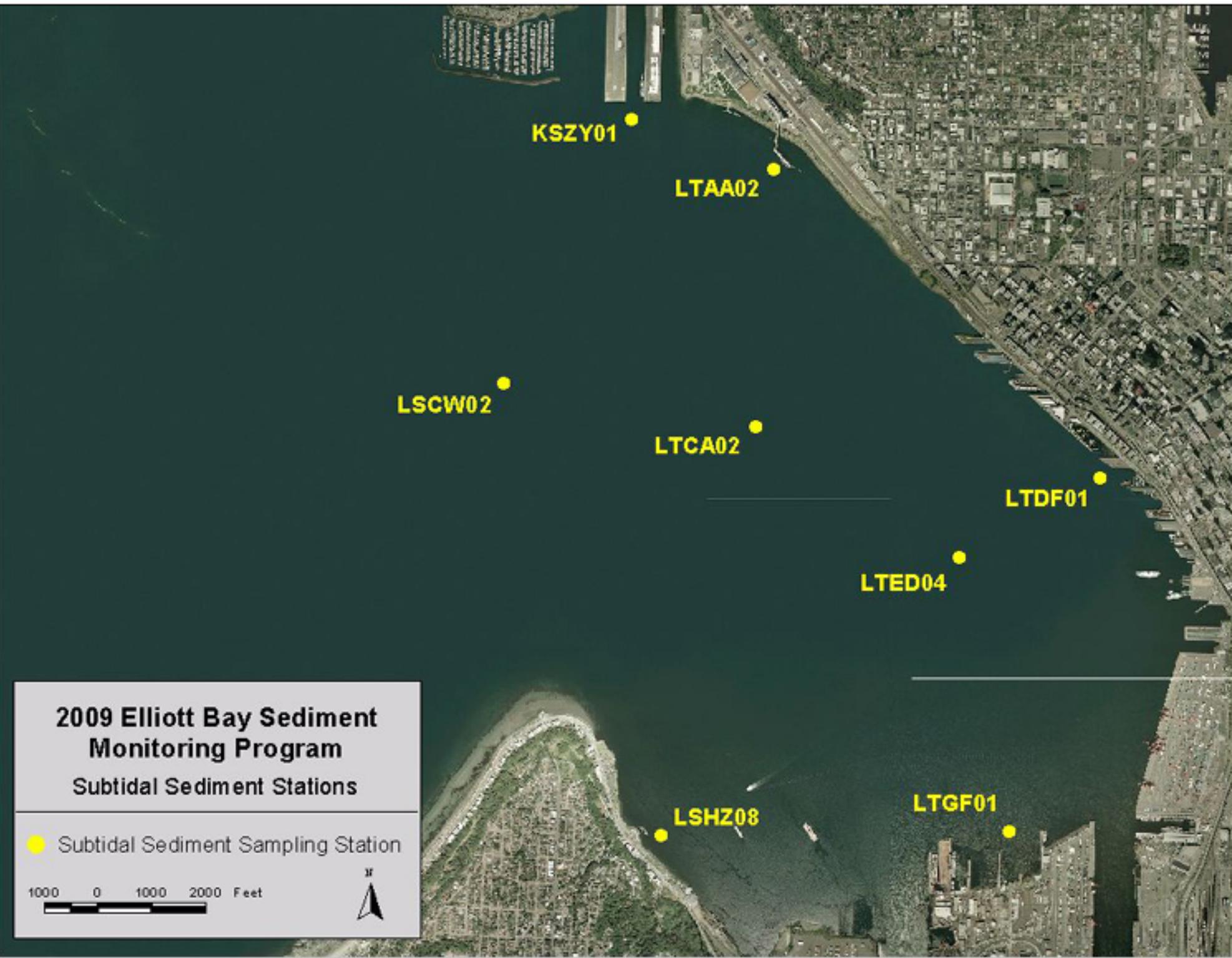
Samples will be collected from the 0 to 2 cm depth stratum.

Samples will be composited from a single deployment of dual van Veen grab samplers, unless additional deployments are needed to get sufficient sediment for all analyses

Metals will include Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Se, Ag, Sn, and Zn.

All analyses will be performed following QA1 guidance.

A new SAP for 2009 will be provided.



**2009 Elliott Bay Sediment
Monitoring Program
Subtidal Sediment Stations**

● Subtidal Sediment Sampling Station

1000 0 1000 2000 Feet

