Seattle Public Utilities

Protecting Seattle's Waterways

Final Post Construction Monitoring Program

May 29, 2015

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

Term	Definition
AG	Washington State Office of the Attorney General
CMMS	Computerized Maintenance Management System
CMOM	Capacity, Management, Operations, and Maintenance
CSO	Combined Sewer Overflow
DGPS	Differential Global Positioning System
DOJ	U.S. Department of Justice
DNRP	King County Department of Natural Resources and Parks
DWO	Dry Weather Overflow
Ecology	Washington State Department of Ecology
EIM	Department of Ecology Environmental Information Management
EPA	U.S. Environmental Protection Agency
FSE	Food Service Establishment
GC/CM	General Contractor/Construction Manager
GSI	Green Stormwater Infrastructure (see also NDS, LID)
KCEL	King County Environmental Laboratory
LAET	Lowest Apparent Effects Threshold
LID	Low Impact Development (see also NDS, GSI)
LTCP	Long-Term Control Plan
m	meter
m2	square meters
MG	million gallons
MGD	million gallons per day
mg/kg	milligrams per kilogram
MODA	Multi Objective Decision Analysis
NDS	Natural Drainage Systems (see also GSI, LID)
NPDES	National Pollutant Discharge Elimination System
PACP	Pipeline Assessment and Certification Program
PCBs	polychlorinated biphenyls
PMP	Project Management Plan
RCM	Reliability Centered Maintenance
SAP	Sampling and Analysis Plan
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
SPU	Seattle Public Utilities
SQS	Washington Administrative Code Sediment Quality Standards
SSO	Sanitary Sewer Overflow
SVOCs	semivolatile organic compounds
WAC	Washington Administrative Code
WTD	King County Wastewater Treatment Division

1. Background

The City of Seattle (City) is a Combined Sewer Overflow (CSO) permittee under the National Pollutant Discharge Elimination System (NPDES) Program, which is administered by the Department of Ecology (Ecology) in the State of Washington (Permit No. WA0031682, issued October 27, 2010; effective December 1, 2010; Modified September 13, 2012; expires November 30, 2015). The NPDES permit authorizes the City to discharge at 87 CSO outfalls. Figure 1 on the following pages shows the locations of the City's CSO outfalls.

The City of Seattle is currently in the process of implementing CSO controls in accordance with its NPDES permit, the federal Clean Water Act (including the CSO Control Policy), and Washington State Law (Revised Code of Washington and Washington Administrative Code). The two-fold goal of the City's CSO Reduction Program is to reduce all CSOs to an average of no more than one overflow per outfall per year by 2025 (the State of Washington performance standard for controlled CSOs) and to meet applicable sediment standards.

In accordance with Section S8C of the City's 2005-2010 combined sewer system NPDES permit, SPU was required to prepare a Post-Construction Compliance Monitoring Program (PCMP) as described below:

> "The Permittee shall develop and submit a post-construction monitoring program that (a) measures the effectiveness of the CSO controls and (b) can be used to demonstrate attainment of water quality and sediment standards. The program shall include a plan that details the monitoring protocols to be followed, including CSO and ambient monitoring and, where appropriate, other monitoring protocols, such as biological assessments, whole effluent toxicity testing, and sediment sampling The Post-Construction Monitoring Program DRAFT and FINAL reports shall be submitted to the Department by June 30, 2009, and May 31, 2010, respectively."

In April 2010, SPU submitted a Final PCMP in accordance with the requirements of the 2005-2010 NPDES permit. SPU subsequently received Ecology's approval of the Final PCMP on June 3, 2010. On August 10, 2010, Ecology sent a follow-up letter to SPU clarifying its previous approval. Specifically, Ecology stated the following:

> "During the drafting of the City's National Pollutant Discharge Elimination System (NPDES) permit, it has come to Ecology's attention that the sediment sampling and monitoring proposed in PCMP's Sections 3.2.3 and 3.3 is not adequate for characterization purposes with the State's sediment management standards (SMS). Specifically, the City plans to collect CSO "solids" in the collection system, to analyze these solids for various parameters and to perform sediment fate and transport modeling to assess compliance with the SMS is insufficient. For purposes of complying with the SMS, Ecology will require in-situ monitoring of sediments." (Letter from Kevin Fitzpatrick, Department of Ecology, dated August 10, 2010)

In addition, during Ecology's review of a draft Quality Assurance Project Plan (QAPP) for post-construction monitoring at Outfall 62, Ecology provided further guidance on the requirement for receiving water quality monitoring. Specifically, Ecology provided comments to SPU's Draft QAPP for Basin 62, in which they stated that receiving water quality monitoring would not be required:

> "WAC 173-201A-400(11) allows an average once per year exemption to the mixing zone numeric size criteria. If controlled to a once/year average, Ecology assumes the numeric WQ standards are met and there's no need to monitor receiving water. Permittee only needs to show the discharge meets the "average of one overflow event per site per year" requirement, the narrative standards [WAC 173-201A-260(2)], and sediment standards [WAC 173-204]." (Comments from Department of Ecology to Draft QAPP for Basin 62, dated August 27, 2012)

Based on Ecology's clarifications regarding the requirement for in-situ sediment sampling and the absence of a requirement for receiving water monitoring, SPU has revised its Post Construction Monitoring Program – Final

Report to reflect the aforementioned changes and to meet the consent decree requirement to include a site-specific schedule This updated PCMP supersedes SPU's 2010 Post-Construction Monitoring Plan, since it incorporates regulatory guidance that has been provided since 2010 and (a)reflects Ecology's direction to sample at the highest overflow frequency and/or largest volume outfalls in each receiving water body and (b) the projects and implementation schedule in the City Council approved Plan to Protect Seattle's Waterways.

Consistent with Paragraph 20.d of the City's Consent Decree this PCMP serves two purposes: (1) measure effectiveness of CSO controls to meet the CSO frequency requirement, and (2) demonstrate attainment of narrative water quality criteria and sediment standards. The Washington Administrative Code (WAC) 173-201A and 173-204 provide the requirements that are the basis for evaluating attainment of water quality criteria and sediment standards.

Subsequent to Ecology's approval of the 2010 Final PCMP, two Quality Assurance Project Plans (QAPP) were developed: Sediment Sampling and Analysis Plan for CSO Outfalls 107, 147, and 152, FINAL REPORT (draft revised on April 5, 2013); and Quality Assurance Project Plan and Sediment Sampling and Analysis Plan for CSO Outfall 62, FINAL REPORT (draft revised on April 5, 2013 as part of the monitoring program implementation).

Compliance with the CSO performance standard, narrative water quality criteria and sediment standards have been used to define the study design.

1.1 The Planning Team

To facilitate the development of this PCMP, SPU assembled a multi-disciplinary planning team. The members of this team and their respective roles are as follows:

- Betty Meyer, Wastewater Regulatory Compliance Manager
- Ed Mirabella, Project Manager
- Jonathan Frodge, Technical Lead
- Pete Rude, Sediments Specialist

1.2 The Data Quality Objectives Process

This PCMP is submitted in a Data Quality Objectives (DQO) format. The DQO Process was used to develop the Post-Construction Monitoring Program required in the City of Seattle's CSO NPDES permit. The DQO process is a systematic planning process for generating environmental data that will be sufficient for their intended use. The DQO process includes seven (7) steps (USEPA 2006 and Ecology 2004):

- Step 1 State the Problem
- Step 2 Identify the Decision
- Step 3 Identify Inputs to the Decision
- Step 4 Define the Boundaries of the Study
- Step 5 Develop a Decision Rule
- Step 6 Specify Performance or Acceptance Criteria
- Step 7 Develop the Plan for Obtaining Data

The outline of this PCMP follows these seven steps.

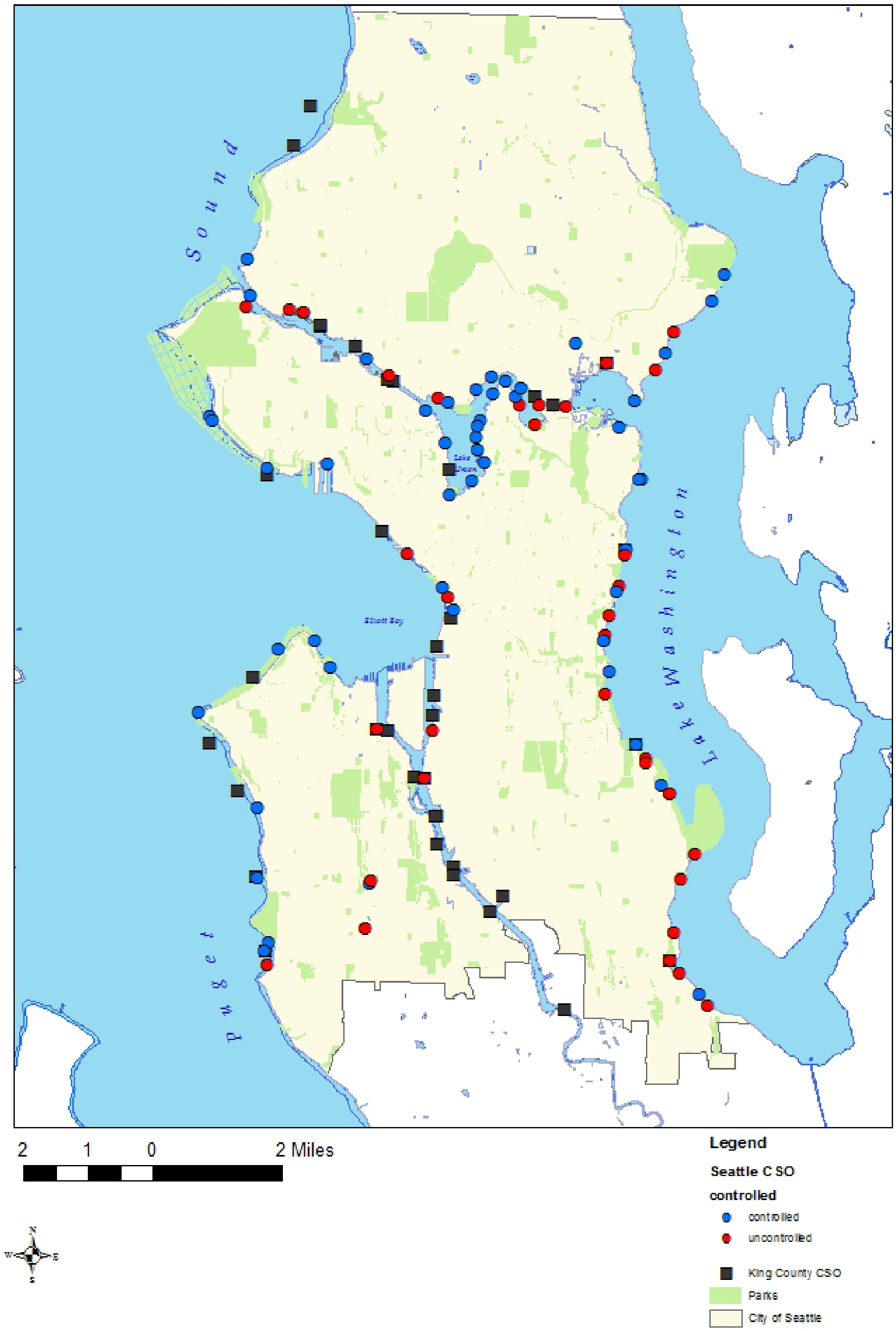

Figure 1. DNRP CSO outfalls and SPU controlled and uncontrolled CSO outfalls

2. The Problem Statement

As documented by both the Environmental Protection Agency (EPA) and the Department of Ecology (Ecology), CSOs collectively and individually can be a major source of pollution to the nation's and region's receiving water bodies. The potential impacts of individual or multiple CSOs can include impairment of the receiving water body, contamination of sediments, and inability to achieve designated uses. Specific impacts vary with composition and volume of effluent, frequency and timing of overflow events, location and design of outfalls, and type of receiving water.

Both EPA and Ecology have created guidance on the development and implementation of both short-term (i.e., Nine Minimum Controls) and longer-term, more capital-intensive programs (i.e., Long Term Control Plan or CSO Reduction Plan) to reduce CSOs with the goal of attaining water quality standards in receiving water bodies. The design of SPU's CSO Reduction Program relies on the assumption that controlling CSOs to no more than one overflow per outfall per year will achieve water quality standards, or what EPA defines as a "presumptive approach" to CSO control. "The CSO control goals are developed under the assumption that if the other sources were remediated by the appropriate responsible parties, then the CSO control goals would be stringent enough for water quality goals to be met." (Section 1.6.5, EPA Long Term Control Plan guidance) State regulations (WAC 173-201A-400(11)), provide an exemption from mixing zone size limits for CSO outfalls that are controlled to an average of no more than one overflow per year, providing the discharge would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health as determined by Ecology. Assuming these requirements are met, Ecology assumes the numeric water quality standards also are met and does not require receiving water sampling and analysis. Therefore, compliance with water quality standards requires demonstration that the controlled CSO discharge meets the "average of no more than one overflow event per outfall per year" requirement, the narrative water quality standards [WAC 173-201A-260(2)], and sediment standards [WAC 173-204].

3. The Decision

The PCMP is designed to answer specific study questions, with the objective of determining whether subsequent actions are necessary to meet the goals of the program. The following section defines the study questions, outlines the alternative actions that could result from resolution of the principal study question, and specifies decision statements (i.e., study objectives).

3.1 Principal Study Questions

This PCMP is designed to answer two study questions:

1. Are CSO controls (as designed and constructed per the presumptive approach) effective at reducing CSOs to an average of one overflow event per outfall per year?

2. Once CSO control per the presumptive approach is fully achieved, do CSOs cause or contribute to the non-attainment of narrative water quality criteria and sediment standards?

The answer to the first study question (effectiveness of CSO controls) relies on modeling and measurement of post-project frequency and volume of CSOs at each site to verify that the CSO discharges on average of less than one event per year.

The answer to the second study question is dependent on whether the post-project CSOs at each site meet the narrative water quality criteria in WAC173-201A and/or cause or contribute to non-attainment of sediment standards, as described in WAC 173-204 (Sediment Standards). Non-attainment of narrative water quality and sediment standards is defined as the inability to meet the applicable numeric and criteria specified in the standards. Further detail on the numeric and narrative criteria will be provided in Section 3 (Inputs to the Decision).

This PCMP includes metrics to estimate the attainment or non-attainment of narrative water quality criteria and sediment standards after construction completion of the CSO control measures included in the Plan to Protect Seattle's Waterways, per WAC 173-201A and WAC 173-204. In particular, attention will be given to identifying metrics that achieve the following objectives:

- Measure attainment of numeric sediment standards and narrative water quality criteria, and;
- Evaluate whether CSOs cause or contribute to “adverse impacts that threaten characteristic uses of the receiving water”.

3.2 Alternative Actions Resulting from Resolution of Study Questions

Table 1 summarizes the alternative actions that could result from answering the two study questions:

Table 1. Alternative Actions Resulting from Resolution of Study Questions

Study Question	Potential Answers	Resulting Actions
Are CSO controls effective at controlling CSOs to an average of 1 event per year?	CSO outfall is controlled to an average of less than 1 per outfall per year	No action
	CSO outfall still exceeds an average of 1 overflow event per outfall per year	Corrective action defined in LTCP (i.e., plan, design, and implement or construct additional programmatic or capital improvements to achieve an average of less than 1 overflow per outfall per year.)
Are CSOs causing or contributing to non-attainment of narrative water quality and sediment standards?	Water quality narrative criteria are met at point of compliance.	No action
	Water quality narrative criteria and sediment standards not met, in part or in whole; would not qualify for a mixing zone size limit exemption per WAC 173-201A-400 (4).	Multiple actions may be pursued, including but not limited to upstream source control and pollution prevention or programmatic improvements, additional engineering and construction improvements, or regulatory instruments (e.g., TMDL, UAA, etc.)

3.3 Decision Statements

The decision statements (aka, project objectives) of the PCMP are as follows:

1. Determine whether or not implemented CSO controls are effective at limiting CSOs to no more than 1 overflow per outfall per year.

2. Determine whether or not CSOs are causing or contributing to non-attainment of narrative water quality criteria and sediment standards.

4. Inputs to the Decision

The PCMP identifies the information that is required to answer the two study questions. The following section describes the inputs to the decision, determines the sources of the information, identifies the information that is needed to establish the action level, and confirms that appropriate methods exist to provide the necessary data.

4.1 Information Required to Resolve the Decision Statement

The information necessary to answer the two study questions and resolve the two decision statements described in Section 2 are as follows:

- Combined Sewer Overflow
  - Monitoring for overflow frequency and volume
  - Basin hydraulic modeling
  - Solids composition
- Receiving Water
  - Narrative water quality criteria
  - Designated use data
- Sediment
  - Sediment fate and transport
  - Attainment of sediment criteria

Table 2 provides details on the information that is needed to resolve the study questions and decision statements.

Table 2. Information to Resolve Decision Statements

CSO Decision Statement	Information Category	Potential Source(s) of Information	Potential Parameters
CSO Control Effectiveness	Combined Sewer Overflow	monitoring	Quantity: volume, duration, and frequency
		modeling	Quantity: (flow) for volume, duration, and frequency
Attainment of narrative water quality and sediment standards	Receiving Water	visual monitoring	Attainment of designated uses such as recreational uses, water supply uses, shellfish harvesting uses, aquatic life uses, and miscellaneous uses (boating, aesthetics, commerce and navigation, and wildlife habitat).
	Sediment	sampling and analysis	In-Situ sediment monitoring[1] - CSO solids characterization - In collection system – sediment accumulation, particle size distribution, chemical composition
		analysis	Attainment of appropriate sediment quality standards

[1]Requirements for in-situ sediment sampling in the waterbody adjacent to the surrogate outfall or in-pipe sampling of the outfall will be specified in the project specific Quality Assurance Project Plans (QAPP).

4.2 Sources of Information

Both monitoring and modeling will be used to generate the information that is required to resolve the two decision statements. In addition, existing data and information will be utilized, wherever it is available.

4.2.1 Combined Sewer Overflow Monitoring and Modeling

To resolve both decision statements, CSO frequency and volume must be quantified both before and after construction of CSO control projects. This information is particularly critical for determining the effectiveness of the CSO control projects in achieving an average of one overflow per site per year target. The source of CSO quantity data is both flow monitoring and hydrologic/hydraulic modeling. SPU has performed flow monitoring of CSOs at its outfalls since 2001, and, therefore, pre-project CSO quantification will be available. SPU will conduct flow monitoring at the CSO outfalls following construction of the control projects, and, therefore, post-project CSO quantification will also be available. In some cases, hydrologic/hydraulic models will be used where monitoring data are unavailable or unreliable. Model output will also be used to generate longer-term (i.e., 20-year) overflow projections, both pre- and post-project. SPU has built and calibrated, or is in the process of building and calibrating, hydrologic/hydraulic models of its CSO basins. Historical data on CSO frequency and volume is provided in Appendix A.

Measurement of CSO frequency and volume is currently performed using area-velocity (AV) flow monitors. More specifically, SPU has standardized on the ADS manufactured equipment as its flow monitoring instrument for measuring CSO frequency and volume. The ADS flow monitors have three sensors (ultrasonic depth, pressure depth, and Doppler velocity). The ultrasonic depth sensor is the primary sensor for measuring depth in the pipeline, and in some cases, depth over a weir. The pressure sensor is a redundant depth sensor that records depths, primarily during surcharge conditions. The velocity sensor is used when direct measurement in the overflow pipe is the most accurate measurement of overflow volume. ADS flow monitoring equipment has been used as the primary instrument for CSO flow monitoring since 2007 has proven to be a reliable and accurate instrument for flow monitoring. The ADS flow monitoring equipment specifications, including the method detection limit (MDL) and limits of quantification (LOQ) will be included in the PCMP QAPP.

Modeling of CSO frequency and volume is currently performed using hydrologic/hydraulic models such as InfoWorks, EPA SWMM5 and Mike Urban (MOUSE). The models simulate both the basin hydrology and the hydraulics of the sewer system to estimate CSO frequency and volume over an extended period (i.e., 20 years). Inputs to the model include land-use, sewer characteristics (i.e., pipe size, pipe material and condition, pipe invert elevations and slopes, weir heights, structure configuration, storage size, pump station operational parameters, real-time controls, etc.), dry weather flow patterns, and rainfall. The models are calibrated with flow monitoring data, so that actual conditions are simulated as closely as possible. The specific models for evaluating the effectiveness of projects will be further described in each basin's QAPP.

4.2.2 Receiving Water Narrative Standards

Evaluation of data collected by others and ongoing studies in the Region plus visual observations CSO events will provide the information needed to address the second decision statement.

Narrative criteria in WAC 173-201A relate directly to designated uses of the water bodies. Designated uses for freshwater include aquatic life uses, recreational uses, water supply uses, and miscellaneous uses, including wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics. Currently no approved water supply uses occur in waters where Seattle CSOs discharge. Designated uses for marine waters include aquatic life uses, shellfish harvesting, recreational uses, and miscellaneous uses.

Under state law, the designated use of water is to be protected from toxic substances (WAC 173-201A-240) and from degradation (WAC 173-201A-300). WAC 173-201A-300 states that, "existing and designated uses must be maintained and protected. No degradation may be allowed that would interfere with, or become injurious to, existing designated uses."

Evaluating the referenced data sources for the designated use of the receiving water, as indicated Table 3, will provide the information needed to answer the question of attainment or non-attainment of water quality criteria.

Table 3. Designated use Data

Designated use		**Data source**
Category	parameter	
Recreation	Fecal Coliform	King County swimming beach survey
	Primary/secondary contact	Available survey data (King County)
	Waterfowl counts	Available survey data
Water supply	n/a	n/a
Aesthetics	Foam, floatables,	Visual observation, citizen reports
	turbidity	Visual observation
	odor	Citizen reports
Fish	Water quality and Toxics in water	CSO Supplemental Characterization Study (Washington Department of Public Health)
	Toxics in tissue	Existing fish tissue studies, caged mussel surveys (Washington Department of Public Health)
	Benthic invertebrate community	Existing literature
Wildlife habitat	Bird counts	Existing local studies
	Nearshore habitat	Existing local studies
Shellfish	Toxics (metals, organics)	Caged mussel survey at CSO outfalls , existing literature (WDFW)
	Population distribution	Seattle Aquarium beach rangers

4.2.3 Sediment

SPU, in response to Special Condition 9 of its 2005-2010 combined sewer system NPDES permit, prepared a Sediment Survey Report (Herrera 2007). The report evaluated sediment quality data gathered within 250 and 775 feet of SPU's CSO outfalls. Although the reported data were not necessarily collected with the intent of evaluating CSOs as potential sources of impacts to sediment quality, the report reached the conclusion that no clear cause-and-effect relationship could be inferred relating discharges from CSO outfalls to effects on surface sediment quality. This was based on the observations that sediment sample results near many outfalls did not exceed applicable sediment criteria, and, where results did indicate exceedances of applicable criteria, there were multiple historical and current sources of contaminants present that made linkage to any particular source or sources very difficult.

The area of influence in which discharge of CSO effluent from an outfall may affect sediment quality depends on many complex and site-specific processes and conditions such as:

- The CSO flow rate and the volume and timing of discharge
- The quality and concentration of solids in the CSO effluent
- The outfall configuration
- The hydrodynamics of the receiving water body
- Sediment transport processes within the receiving water body
- Chemical partitioning behavior between water, solid, and colloidal phases
- Biological processes

To further investigate the potential for CSO effluent to have an adverse impact on sediment quality, the following monitoring and evaluation activities are proposed:

- Collation and evaluation of existing CSO solids data generated by other parties
- Monitoring of solids collected from within selected SPU combined sewer overflow pipes or off-shore locations identified in project specific QAPPs.
- Review of other sediment monitoring efforts
- Where appropriate, simple predictive modeling of potential sediment impacts based on CSO solids inputs to the receiving water body.

King County and possibly other entities have begun to collect solids from their CSOs as part of ongoing sediment source control efforts. Solids that are present in the CSO effluent are collected via sediment traps or in-line solids grabs of material accumulated in lines. The City will identify, assemble, and evaluate environmental data generated for CSO solids by King County and other municipalities or regulated entities.

Samples of solids accumulating in City combined sewer overflow piping or off-shore locations will be collected and analyzed. Collected solids will undergo laboratory testing for Sediment Management Standards constituents, total organic carbon, and grain size. Testing results will be compared to applicable sediment screening criteria to better understand, in general, the potential for such solids to impact sediment quality in a receiving water body.

On February 22, 2013, Ecology adopted revisions to the Sediment Management Standards that included the addition of numeric chemical criteria for evaluation of freshwater sediment quality. The revised standards went into effect on September 1, 2013. Appropriate comparisons of marine or freshwater numeric criteria will be incorporated into the QAPPs.

4.3 Information Needed to Establish Action Levels

This part of the DQO process calls for a determination of the basis of the action level, a threshold value for determining which alternative action will be taken. Action levels are specified later in Step 5. However, the source of the information needed to establish the action level is specified in Table 4. Action levels for individual parameters are based on regulatory standards contained in the WAC 173-240 (CSOs), WAC 173-201A (Water Quality Standards) and WAC 173-204 (Sediment Standards).

Table 4. Action Levels

Category	Sub-Category	Parameters	Action Level Source
Combined Sewer Overflow	Quantity	Frequency, duration, and volume	WAC 173-240 and NPDES Combined Sewer System Permit
Sediment	CSO Solids Characterization (in collection system)	Sediment accumulation, particle size distribution, chemical	No action level, for sediment fate and transport modeling use.
	In-situ sediment	Recreational use	WAC 173-204 numeric criteria
Sediment Receiving water	CSO Solids Characterization (in collection system)	Shellfish harvesting use	No action level, for sediment fate and transport modeling use.
	Designated uses	Aquatic life use	WAC 173-201A narrative criteria for parameters monitored
Receiving water	Designated uses	Miscellaneous uses (boating, aesthetics, commerce, navigation, wildlife habitat)	WAC 173-201A narrative criteria for parameters monitored
		Recreational use	

5. Boundaries of the Study

The PCMP has defined spatial and temporal boundaries which provide focus to the monitoring and modeling program to address the decision statements. The following section specifies the characteristics that define the population of interest, defines the spatial boundaries of the decision statements, defines the temporal boundaries of the problem, and identifies practical constraints on data collection.

5.1 Population of Interest

The first action of this step is to specify the characteristics that define the population of interest. The population of interest includes the water bodies that receive the combined sewer overflow. These water bodies are Lake Washington, Lake Union/Ship Canal, Duwamish River, Longfellow Creek, Elliott Bay, and Puget Sound. Table 5 shows the designated uses for each of these water bodies (according to WAC 173-201A). In addition, Table 5 refers to the relevant narrative surface water quality criteria for each water body.

Section 303(d) of the federal Clean Water Act requires Washington State to prepare a list of all surface waters in the state for which designated uses are impaired by pollutants. These surface waters fall short of state surface water quality standards. Several 303(d) listings occur in these water bodies that make up the population of interest. 303(d) category 5 impaired waters include Longfellow Creek for fecal coliform and dissolved oxygen; Lake Union/Ship Canal for lead, aldrin, and fecal coliform; Lake Washington for fecal coliform; Puget Sound (Central) for fecal coliform; and Elliott Bay for fecal coliform. This is a partial list based on water samples only. Additional 303d listings exist for fish tissue and sediment.

5.2 Spatial Boundary

SPU's Combined Sewer System NPDES Permit includes 87 outfalls permitted for CSO discharge, including one outfall that was sealed and removed from service in 2014 (Outfall 26). SPU proposes to control all SPU CSO outfalls to an average of one overflow per year or less. This PCMP is designed to collect information on CSO discharge and CSO impacts to receiving waters narrative criteria and sediment for all water bodies receiving CSO discharges.

The configuration of the combined sewer collection system in Seattle results in CSO outfalls discharging to marine, freshwater, lake and riverine systems. These include Lake Washington, Lake Union, the Ship Canal, Longfellow Creek, Duwamish River, Elliott Bay and Puget Sound. The differences in the detention times, salinity, biological communities, designated uses and the regulatory requirements require treating the water bodies as distinct strata from an information collection perspective. The currents and detention times of the respective receiving water will most strongly influence CSO discharge mixing, dilution, and water quality impacts.

Rather than collect information at all permitted outfalls, SPU plans to collect information at key surrogate CSO outfalls in each of the different receiving waters into which the CSOs discharge. This assumes that monitoring data collected at the selected outfalls will be sufficient and applicable to evaluate the attainment or non-attainment of narrative water quality criteria and sediment standards at all of the SPU outfalls after completion of the LTCP. This approach will allow SPU to estimate the influence of all of SPU's CSOs to potentially cause or contribute to the non-attainment of narrative water quality criteria and sediment standards.

Fourteen (14) surrogate CSO outfalls will be evaluated using the monitoring and modeling activities identified in this PCMP (Figure 2 and Table 6). The surrogate outfalls selected for monitoring currently contribute substantial overflow volumes and are assumed to be representative of the CSOs that discharge into these various major receiving water bodies. Appendix A includes more information on each of the proposed surrogate outfalls.

Selection of the specific CSO outfalls for inclusion in the PCMP was based on current CSO overflow volume, number of CSO events, contributing basin area size and land use, and receiving water. Initially, all SPU CSO outfalls were grouped by receiving water. Then, the number of overflow events and CSO volume per year (based on data from years 2010-2014) were compared within each receiving water strata. Only wet weather events were used in the selection process.

Because the surrogate outfall selection approach is not random, SPU will not be able to statistically describe the impact of all of the CSOs. However, the selected CSO outfalls are assumed to be representative of sites with potentially the greatest water quality impacts. While this design is not statistically rigorous, it is sufficient to allow for the evaluation of the potentially maximum impacts of the CSOs on the receiving water.

The spatial extent of monitoring in proximity of each individual outfall is currently not defined. It is assumed that any monitoring will be located in the immediate proximity of a particular outfall; how far the monitoring should occur from the actual opening of the outfall is not defined.

Table 5. Relevant surface water narrative criteria for receiving water bodies

	Designated Uses	Aquatic Life Uses -						Recreational Uses				Water Supply Uses				Misc. Uses				
	Applicable narrative criteria[a]	Char Spawning / Rearing	Core Summer Habitat	Spawning / Rearing	Rearing / Migration	Redband Trout	Warm Water Species	Shellfish Harvesting	Extraordinary Primary Contact	Primary Contact	Secondary Contact	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Location	Longfellow Creek				X							X	X	X	X	X	X	X	X	X
	Lake Washington[b]	X		X	X		X					X	X	X	X	X	X	X	X	X
	Lake Union / Ship Canal[b]				X		X					X	X	X	X	X	X	X	X	X
	Duwamish River [c]			X									X	X	X	X	X	X	X	X
	Elliott Bay[d]		X		X			X		X						X	X	X	X	X
	Puget Sound[e]		X		X			X		X						X	X	X	X	X

Notes:

[a] *Surface water criteria: WAC173-201A Table 602:*

[b] *Lake Washington Ship Canal from Government Locks (river mile 1.0) to Lake Washington (river mile 8.6)*

[c] *Duwamish R from mouth south of a line bearing 254° true from the NW corner of berth 3, terminal No. 37 to the Black R (river mile 11.0) (Duwamish R continues as the Green R above Black R).*

[d] *Elliott Bay east of a line between Pier 91 and Duwamish Head.*

[e] *Puget Sound through Admiralty Inlet and South Puget Sound, south and west to longitude 122°52'30"W (Brisco Point) and longitude 122°51'W (northern tip of Hartstene Island).*

5.3 Temporal Boundary

SPU is in the process of implementing a capital program to reduce its CSOs, described in detail in the Plan to Protect Seattle's Waterways. The flow monitoring requirements of the PCMP are currently being implemented, and will continue to be implemented during and following completion of the capital program. Modeling elements of the PCMP should be implemented following the construction activities of the capital program. Performing modeling prior to the construction of the capital program will not satisfy the requirements of the PCMP since the PCMP is focused on *post*-construction monitoring, or resolving whether CSOs are causing or contributing to non-attainment of narrative water quality criteria and sediment standards following implementation and construction of the capital program.

Attainment of flow control of CSO discharges to an average of no more than 1 event/year will constitute the presumption that the CSOs do not substantively contribute to the non-attainment of water quality criteria and the only water quality criteria that will be evaluated will be the narrative criteria in WAC173-201A. One year following Construction Completion of each CSO Control Measure, overflow frequency will be confirmed using one year of flow monitoring data and 19 years of long-term simulation modeling using a 20-year period of historical rainfall data. Achievement of control status will be documented in the City's Annual by March 31, the following year. However, if there is insufficient precipitation during the year following Construction Completion to demonstrate that a CSO Outfall has been controlled, then the deadline will be extended until there is sufficient precipitation to make the demonstration.

It is estimated that it will take approximately 3 years to complete in-pipe sediment sampling and analysis to demonstrate that numeric criteria in WAC 173-204 are attained. If there is insufficient rainfall during the 3 year post-construction monitoring period, then additional monitoring years will be required. In-situ sediment samples in the waterbody adjacent to the surrogate outfalls can be collected and characterized at any time during the year, during either dry weather or wet weather conditions. The in-situ sediment data can be collected at any time during the 3 year post-construction monitoring period.

The City's NPDES Waste Discharge Permit requires collection of sediments and submission of Sediment Data Reports for CSO 62, 107, 147 and 152 by November 30, 2015. For these basins, the PCMP requirements to demonstrate attainment of sediment standards will be fulfilled by the collection over a 1-year period and analysis of in-pipe samples collected under the approved Sediment Sampling and Analysis Plan for CSO Outfalls 62 (approved 4/16/13),107, 147, and 152 (approved 3/4/14) , assuming that the analyses show compliance.

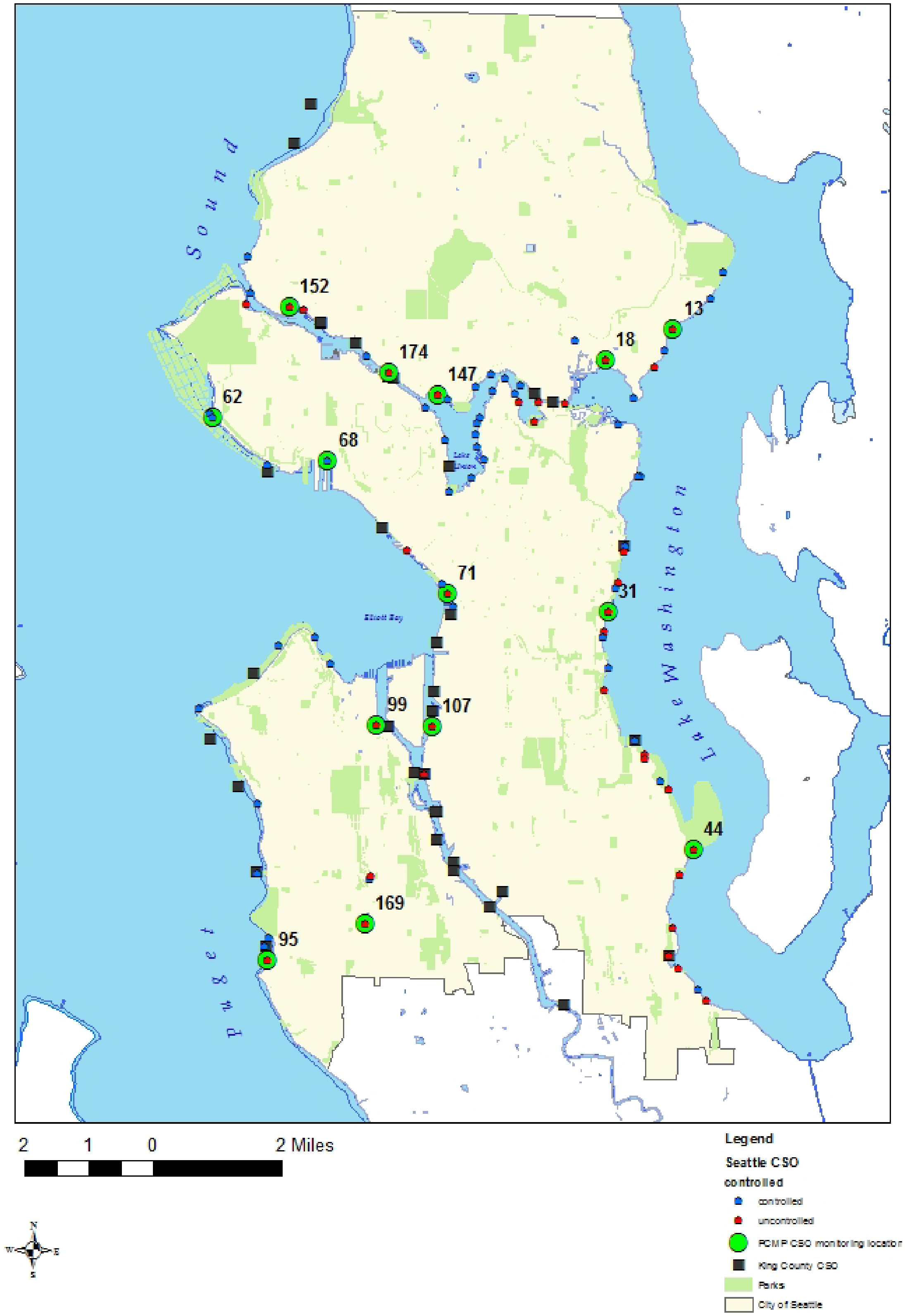

Figure 2 . Draft PCMP Receiving Water Monitoring Locations Adjacent to SPU CSO Outfall

Table 6. Surrogate CSO Outfalls

Outfall Number	CSO Basin	Receiving Water	Receiving Water type	Frequency of Overflow (No. per year)	Overflow Volume (MG per year)	Discharge Depth (ft) [1,2]	Distance from Shore (ft)) [1,2]
169	Delridge	Longfellow Creek	freshwater stream	≥1 and <5	2.1	0.5	0
62	Magnolia	Elliott Bay	Marine	≥1 and <5	0.001	12	302
95	West Seattle	Puget Sound	Marine	≥1 and <5	0.04	8	110
68	Magnolia/Interbay	Elliott Bay	Marine	<1	1.0	4	0
71	University Street	Elliott Bay	Marine	≥1 and <5	0.5	2	0
152	Ballard	Salmon Bay	Freshwater lake	>5	37.5	10	60
147	Fremont	Lake Union	Freshwater lake	>5	12.9	5	10
174	Fremont	Ship Canal	Freshwater lake	>5	7.5	0.5	0
13	Windermere	Lake Washington	Freshwater lake	>5	5.1	27	500
18	North Union Bay	Lake Washington	Freshwater lake	≥1 and <5	6.7	At surface	5
44	Henderson	Lake Washington	Freshwater lake	>5	8.7	19	565
31	Leschi	Lake Washington	Freshwater lake	>5	0.3	12	82
99	Delridge	West Waterway of Duwamish RIver	River	≥1 and <5	1.8	0	0
107	East Waterway	East Waterway of Duwamish River	River	>5	1.2	5	0

Notes:

[1]Based on the depth at the time of the outfall inspection (Herrera Environmental Consultants; 2002-2005).

[2]Physical condition factors of each discharge is provided in the Outfall Evaluation Report: Summary Report and Condition Assessment and Criticality Analysis: Findings and Recommendations (Herrera Environmental Consultants, August 2006)

5.4 Practical Constraints on Data Collection

Any monitoring and modeling program has its own obstacles to data collection, such as the availability of sampling equipment or personnel or gaining permission to investigate a property. This PCMP has elements of monitoring within the collection system, within the receiving water, and of designated uses of the resource, each with its individual obstacles. Obstacles include the following:

- Health and Safety: Collection of in-situ sediment samples will likely be performed from either a boat or dock. Accesses to collection system monitoring sites have site access obstacles such as traffic control.
- Personnel Availability: Personnel response to storm events is difficult, especially monitoring a CSO event that, in a controlled scenario, occurs an average of no more than once per year.

Other obstacles to data collection will be described in further detail in the Quality Assurance Project Plan and the Sampling and Analysis Plan for this PCMP.

6. Decision Rule

The fifth DQO step involves specifying the action levels and the decision rules for the study. The following section will specify the statistical parameter of interest, the action levels for the study, and the develop decision rule statements for the PCMP.

6.1 Statistical Parameter that Characterizes the Population

The two study questions require different statistical parameters of interest. The answer to the first study question – measurement of the effectiveness of CSO controls – will require calculation of the mean (or average) number of overflows over a long-term (i.e., 20-year) duration. The second study question – measuring contribution to non-attainment of narrative water quality criteria and sediment standards - will be based qualitative attainment of the narrative criteria from WAC173-201A and quantitative attainment of the numeric sediment criteria from WAC 173-204

6.2 Action Level for the PCMP

The second action of DQO Process Step 2 (Identify the Decision) was to define the potential resulting actions that could result from resolution of the principal study questions (Table 1). Table 7 provides more detail on the action level for each parameter or indicator.

Table 7. Action Level for PCMP

Category	Sub-Category	Parameters / Indicators	Action Level Source	Action Level
Combined Sewer Overflow	Quantity	Frequency, duration, and volume	WAC 173-240 and NPDES CSO Permit	Greater than an average of 1 overflow per year
Sediment	CSO Solids Characterization (in collection system)	Sediment accumulation, particle size distribution, chemical	No action level, for sediment fate and transport modeling use only	
	In-situ sediments	Recreational Use	WAC 173-204 numeric criteria	WAC 173-204 applicable numeric criteria for parameters modeled
		Shellfish harvesting use		
Designated use	quality	Shellfish harvesting use	WAC 173-204 narrative criteria	Adversely affect characteristic designated water uses for the water body (recreational, water supply, shellfish harvesting, aquatic life, and misc. uses)? Yes or No Cause acute or chronic toxicity to the most sensitive biota of that water body (aquatic life uses)? Yes or No Adversely affect public health (recreational, water supply)? Yes or No
		Aquatic life use		
		Water supply		
		Recreational use		
		Wildlife		
		Miscellaneous uses (boating, aesthetics, commerce, navigation)		

6.3 Decision Rules

The second action of DQO Process Step 2 (Identify the Decision) was to define the potential resulting actions that could result from resolution of the principal study questions (Table 1). Combining the potential actions of Table 1 with the Action Levels of Table 7 yields decision rules. Decision rules incorporate the parameter of interest, the scale of decision making, the action level, and the actions that would result from the decision. Table 8 shows these decision rules for the PCMP.

Table 8. Decision Rules

Study Question	If	Then
What is the effectiveness of CSO controls?	CSO frequency is within, or less than, action level specified in Table 7	No action
	CSO frequency exceeds action level specified in Table 7	Corrective action (i.e., plan, design, and implement or construct additional programmatic or capital improvements to achieve an average of less than 1 overflow per site per year.)
Are CSOs causing or contributing to non-attainment of narrative water quality and sediment standards?	CSO, sediment, and designated use parameters and Indicators are within action levels specified in Table 7.	No Action
	One or more receiving water, sediment, or designated use parameters and indicators exceed action levels identified in Table 7	Multiple actions may be pursued, including but not limited to upstream source control and pollution prevention or programmatic improvements, additional engineering and construction improvements, or regulatory instruments (e.g., TMDL, UAA, etc.)

The first decision rule – Is the CSO control effective at limiting CSOs to no more than an average of 1 overflow event per year? – will be evaluated based on the 20 year moving average CSO performance requirement. This decision is relatively straight-forward and is answered with data collected from flow monitoring and modeling.

As defined in the second problem statement, the second objective of this PCMP is demonstration that the control of CSOs results in attainment of sediment standards, as defined in WAC173-204, and attainment of narrative water quality criteria as defined in WAC173-201A.

7. Performance or Acceptance Criteria

The purpose of this PCMP is to demonstrate compliance with regulations. Therefore, the monitoring and modeling activities contained in the PCMP will include sufficient sample size to demonstrate compliance with regulations. The minimum sample size to establish statistical significance with regards to regulatory compliance is three samples. When decisions are not based on accepted assumptions it is assumed that no less than three monitoring samples will be necessary to fulfil the requirements of the PCMP.

8. Plan to Obtain Data

This DQO process step consists of selecting a resource-effective data collection design for defining assumptions and collecting data that will satisfy the study questions. The outputs of the previous DQO steps are consistent with the objectives of answering the study questions. Presumptive attainment of water quality criteria, existing data and information will be used to resolve the two decision statements. Information on combined sewer overflow quantity and quality, receiving water quality, sediments, and designated uses will be used to address the study question. The operational details and theoretical assumptions of the PCMP design will be documented in the QAPP(s) based on this PCMP. The most resource-effective data and information collection design that satisfies the objectives of this PCMP will be used. Required resources and a schedule for implementation are described in this section.

8.1 Required Resources

Cost estimates will be provided by SPU in basin-specific QAPPs.

8.2 Schedule for Implementation

Table 9. Post Construction Monitoring Implementation Schedule

Outfall Number	Construction Completion	Submit Quality Assurance Project Plan for approval	Achieve Controlled Status	Complete Implementation of Post Construction Monitoring Plan	Submit Final Post-Construction Monitoring Report
169	9/30/2025	9/30/2025	9/30/2026	9/30/2028	1/28/2029
62	N/A	3/30/2012	Controlled	11/30/2015	11/30/15[1]
95	6/30/2013	3/31/2016	3/31/2016	3/31/2019	7/29/2019
68	N/A	6/30/2016	Controlled	6/30/2019	6/30/19[1]
71	12/31/2020	12/31/2032	12/21/2022	12/31/3035	4/30/3036
152	12/31/2025	1/12/2014	12/31/2026	12/31/3035	4/30/3036
147	12/31/2025	1/12/2014	12/31/2026	12/31/3035	4/30/3036
174	12/31/2025	12/31/1932	12/31/2026	12/31/3035	4/30/3036
13	7/31/2015	8/30/2015	7/31/2016	8/30/2018	12/28/2018
18	9/30/2017	9/30/2017	9/30/2018	9/30/2020	1/28/2021
44	12/31/2018	12/31/2018	12/31/2019	12/31/2021	4/30/2022
31	9/30/2025	9/30/2025	9/30/2026	9/30/2028	1/28/2029
99	9/30/2021	12/31/1932	9/30/2022	12/31/3035	4/30/3036
107	9/30/1930	1/12/2014	9/30/2031	12/31/3035	4/30/3036

[1]*Sediment Data Report*

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NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA0031682

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

City of Seattle, Seattle Public Utilities
700 Fifth Avenue, Suite 4900
P.O. Box 34018
Seattle, WA 98124-4018

Appendix A
Wet Weather Combined Sewer Overflow Events and Volumes (2010-2014)

Appendix A Table 1. Wet weather Combined Sewer Overflow events and volumes in Longfellow Creek 2010 - 2014. Data collected in 2014 has higher reliability than previous years data.

wtrbdy	CSO	wet#10	wetvol10	CSO	wet#11	wetvol11	CSO	wet#12	wetvol12	CSO	wet#13	wetvol13	CSO	wet#14	wetvol14
LFC	**169**	2	6,874,940	**169**	2	614,501	**168**	2	5,364,038	**168**	0	0	**168**	1	1,092,208
LFC	**168**	2	4,824,814	**168**	0	0	**169**	1	2,587,257	**169**	0	0	**169**	1	604,990
LFC	**170**	1	40,069	**170**	0	0	**170**	1	12,286	**170**	0	0	**170**	0	0

Red	highest number of events
Magenta	highest vol discharge
Blue	controlled to 1 event
Light cyan	controlled to 0 events
Yellow	other uncontrolled

Outfall	Average Frequency	Average Volume(gal)
169	1.2	2,136,338
168	1	2,256,212
170	0.4	10,471

Waterbodies

LC **Longfellow Creek**

Appendix A Table 2. Wet weather Combined Sewer Overflow events and volumes in Salmon Bya, Lake Union, Portage Bay and Ship Canal 2010 - 2014. Data collected in 2014 has higher reliability than previous year

wtrbdy	CSO	wet#10	wetvol10	CSO	wet#11	wetvol11	CSO	wet#12	wetvol12	CSO	wet#13	wetvol13	CSO	wet#14	wetvol14
SB	**152**	63	40,356,610	**152**	48	40,634,362	**152**	57	52,382,276	**152**	44	13,192,217	**147**	49	12,316,618
LU	**147**	63	23,213,300	**147**	40	9,748,238	**147**	47	14,636,073	**147**	27	4,800,690	**152**	11	41,104,401
SB	**150 / 151**	29	2,848,612	**150 / 151**	25	2,497,818	**150 / 151**	31	4,871,447	**150 / 151**	14	1,737,206	**150 / 151**	34	3,543,723
SC	**174**	13	9,846,389	**174**	10	5,877,361	**174**	17	10,262,141	**174**	7	2,775,594	**174**	20	8,763,659
PB	**140**	8	755,672	**138**	3	124,027	**60**	6	727,910	**140**	5	147,407	**140**	13	341,627
SB	**60**	4	466,164	**60**	2	174,145	**140**	4	437,331	**138**	2	119,989	**138**	3	264,644
PB	**139**	2	399,306	**148**	2	6,883	**138**	2	649,289	**129**	2	64,910	**60**	2	86,372
PB	**138**	1	1,098,144	**140**	2	3,107	**139**	2	320,403	**132**	2	3,986	**139**	2	47,515
SC	**148**	1	19,092	**139**	1	2,638	**59**	2	95,405	**175**	2	3,062	**59**	0	0
SB	**59**	0	0	**132**	1	2,559	**130**	0	0	**60**	1	47,234	**120**	0	0
LU	**120**	0	0	**59**	1	915	**120**	0	0	**139**	1	47,561	**121**	0	0
LU	**121**	0	0	**120**	0	0	**121**	0	0	**59**	1	11,666	**124**	0	0
LU	**124**	0	0	**121**	0	0	**124**	0	0	**121**	0	0	**127**	0	0
LU	**127**	0	0	**124**	0	0	**127**	0	0	**120**	0	0	**129**	0	0
LU	**129**	0	0	**127**	0	0	**129**	0	0	**124**	0	0	**130**	0	0
SB	**130**	0	0	**129**	0	0	**131**	0	0	**127**	0	0	**131**	0	0
LU	**131**	0	0	**130**	0	0	**132**	0	0	**130**	0	0	**132**	0	0
LU	**132**	0	0	**131**	0	0	**134**	0	0	**131**	0	0	**134**	0	0
LU	**134**	0	0	**134**	0	0	**135**	0	0	**134**	0	0	**135**	0	0
LU	**135**	0	0	**135**	0	0	**136**	0	0	**135**	0	0	**136**	0	0
LU	**136**	0	0	**136**	0	0	**141**	0	0	**136**	0	0	**141**	0	0
PB	**141**	0	0	**141**	0	0	**144**	0	0	**141**	0	0	**144**	0	0
LU	**144**	0	0	**144**	0	0	**145**	0	0	**144**	0	0	**145**	0	0
LU	**145**	0	0	**145**	0	0	**146**	0	0	**145**	0	0	**146**	0	0
LU	**146**	0	0	**146**	0	0	**148**	0	0	**146**	0	0	**148**	0	0
LU	**175**	0	0	**175**	0	0	**175**	0	0	**148**	0	0	**175**	0	0

highest number of events

highest vol discharge

other uncontrolled

controlled to 1 event

controlled to 0 events

Outfall	Average Frequency	Average Volume (gal)
152	45	37,533,973
147	45	12,942,984
150/151	27	3,099,761
174	13	7,505,029
140	6	337,029
60	3	300,365

125	Sealed and removed from service May 2005
172	Sealed and removed from service 1986
20	Moved outfall 20 to L Wash-Union Bay tab

Waterbodies

SB	Salmon Bay
LU	Lake Union
PB	Portage Bay
SC	Ship Canal

Appendix A Table 3. Wet weather Combined Sewer Overflow events and volumes in Lake Washington and Union Bay 2010 - 2014. Data collected in 2014 has higher reliability than previous years data.

wtrbdy	CSO	wet#1	wetvol10	CSO	wet#11	wetvol11	CSO	wet#12	wetvol12	CS)	wet#13	wetvol13	CSO	wet#14	wetvol14
LW	**44**	16	9,887,390	**44**	17	7,331,324	**44**	22	12,327,310	**44**	11	2,873,135	**44**	25	11,257,313
LW	**46**	12	4,197,631	**31**	11	356,655	**45**	14	889,798	**47**	10	2,377,107	**41**	22	2,745,644
LW	**31**	11	957,983	**45**	11	159,235	**43**	14	2,693,671	**171**	10	970,469	**45**	21	520,482
LW	**45**	10	1,322,252	**43**	7	1,136,935	**171**	13	2,199,443	**41**	8	400,178	**13**	15	12,376,374
UB	**43**	9	2,825,223	**47**	7	1,044,960	**41**	13	1,747,947	**45**	7	243,619	**47**	15	2,475,920
LW	**47**	8	10,900,742	**171**	6	828,364	**47**	12	10,000,932	**29**	7	107,553	**171**	15	1,544,026
LW	**18**	5	17,174,989	**41**	5	557,594	**29**	11	299,426	**43**	6	517,740	**43**	14	1,541,559
UB	**13**	5	6,526,814	**18**	4	1,772,295	**40**	10	3,602,239	**22**	3	11,402	**40**	11	2,502,735
LW	**171**	5	3,344,191	**13**	4	1,397,291	**13**	7	4,471,990	**18**	2	1,635,247	**29**	7	134,427
LW	**40**	5	3,207,479	**40**	4	814,849	**49**	5	1,984,105	**49**	2	1,056,726	**28**	7	3,781
LW	**41**	5	1,623,574	**32**	4	368,002	**22**	4	23,146	**13**	2	889,232	**49**	6	2,452,672
LW	**49**	4	4,552,799	**46**	4	88,604	**42**	3	453,768	**40**	2	728,493	**42**	6	489,133
LW	**15**	4	1,409,738	**15**	4	22,529	**30**	3	360,739	**20**	2	209,475	**18**	5	3,350,103
LW	**32**	3	1,111,491	**20**	3	189,159	**32**	3	237,856	**30**	2	103,602	**20**	5	562,408
UB	**20**	3	1,943,677	**29**	3	24,029	**20**	2	762,481	**15**	2	28,466	**31**	5	152,897
LW	**36**	2	256,969	**49**	2	634,667	**15**	2	188,231	**36**	3	8,389	**46**	4	51,982
LW	**29**	2	42,839	**42**	2	82,769	**46**	2	27,595	**28**	3	4,761	**22**	3	16,765
LW	**28**	2	324	**28**	2	1,204	**165**	2	54,470	**24**	1	184,519	**30**	2	149,342
LW	**25**	1	2,402,363	**36**	1	16,852	**36**	2	40,092	**42**	1	125,525	**32**	2	111,411
LW	**24**	1	2,181,178	**22**	1	6,285	**31**	2	8,170	**25**	1	97,238	**34**	2	79,864
LW	**38**	1	2,144,838	**35**	1	1,815	**28**	2	3,931	**32**	1	88,300	**15**	2	66,045
UB	**22**	1	1,193,468	**30**	1	13	**18**	1	9,541,486	**165**	1	4,387	**38**	2	55,731
LW	**42**	1	1,377,285	**12**	0	0	**25**	1	1,214,977	**19**	1	902	**36**	2	26,931
LW	**34**	1	833,946	**14**	0	0	**24**	1	1,179,613	**35**	1	802	**165**	2	8,970
LW	**165**	1	118,552	**16**	0	0	**38**	1	433,405	**12**	1	590	**12**	2	2,612
LW	**12**	1	223,010	**19**	0	0	**34**	1	229,082	**46**	1	281	**35**	2	851
LW	**14**	0	0	**24**	0	0	**12**	1	58,966	**14**	0	0	**14**	0	0
UB	**16**	0	0	**25**	0	0	**35**	1	5,893	**16**	0	0	**16**	0	0
UB	**19**	0	0	**26**	0	0	**33**	1	360	**26**	0	0	**19**	0	0
LW	**26**	0	0	**27**	0	0	**14**	0	0	**27**	0	0	**24**	0	0
LW	**27**	0	0	**33**	0	0	**16**	0	0	**31**	0	0	**25**	0	0
LW	**30**	0	0	**34**	0	0	**19**	0	0	**33**	0	0	**26**	0	0
LW	**35**	0	0	**38**	0	0	**26**	0	0	**34**	0	0	**27**	0	0
LW	**33**	0	0	**48**	0	0	**27**	0	0	**38**	0	0	**33**	0	0
LW	**48**	0	0	**161**	0	0	**48**	0	0	**48**	0	0	**48**	0	0
LW	**161**	0	0	**165**	0	0	**161**	0	0	**161**	0	0	**161**	0	0

(magenta)	highest vol discharge
(red)	highest number of events
(yellow)	other uncontrolled
(blue)	controlled to 1 event
(light cyan)	controlled to 0 events

Waterbodies

LW **Lake Washington**
UB **Union Bay**

Outfall	Average Frequency	Average Volume (gal)
44	18.2	8,735,294
45	12.6	627,077
41	10.6	1,414,987
47	10.4	5,359,932
43	10	1,743,026
171	9.8	1,777,299
13	6.6	5,132,340
40	6.4	2,171,159
29	6	121,655
31	5.8	295,141
18	3.4	6,694,824
46	4.6	873,219
28	3.2	2,800

Appendix A Table 4. Wet weather Combined Sewer Overflow events and volumes in Elliott Bay and Puget Sound Central 2010 - 2014. Data collected in 2014 has higher reliability than previous years data.

wtrbdy	CSO	wet#10	wetvol10	CSO	wet#11	wetvol11	CSO	wet#12	wetvol12	CSO	wet#13	wetvol13	CSO	wet#14	wetvol14
PS-C	**95**	3	179,782	**62**	3	239	**95**	1	4,276	**62**	2	4,428	**62**	2	1,584
PS-C	**88**	1	342,740	**95**	1	744	**62**	1	237	**95**	1	803	**95**	0	0
EB	**61**	1	50,026	**94**	0	0	**90**	0	0	**90**	0	0	**88**	0	0
PS-C	**94**	0	0	**57**	0	0	**94**	0	0	**94**	0	0	**90**	0	0
PS-C	**57**	0	0	**61**	0	0	**57**	0	0	**57**	0	0	**94**	0	0
EB	**62**	0	0	**64**	0	0	**61**	0	0	**61**	0	0	**57**	0	0
EB	**64**	0	0	**83**	0	0	**64**	0	0	**64**	0	0	**61**	0	0
PS-C	**83**	0	0	**85**	0	0	**83**	0	0	**83**	0	0	**64**	0	0
PS-C	**85**	0	0	**88**	0	0	**85**	0	0	**85**	0	0	**83**	0	0
PS-C	**90**	0	0	**90**	0	0	**88**	0	0	**88**	0	0	**85**	0	0
PS-C	**91**	0	0	**91**	0	0	**91**	0	0	**91**	0	0	**91**	0	0

highest number of events

highest vol discharge

other uncontrolled

controlled to 1 event

controlled to 0 events

Outfall	Average Frequency	Average Volume (gal)
62	1.6	1,298
95	1.2	37,121
88	0.2	68,548

63 Sealed and removed from service 2003
56 Sealed and removed from service Sept 13, 20:
Moved Outfall 60 to SB-LU-PB-SC Tab
Moved Outfall 59 to SB-LU-PB-SC Tab

Waterbodies

PS-C **Puget Sound-Central**
EB **Elliott Bay**

Appendix A Table 5. Wet weather Combined Sewer Overflow events and volumes in the East Waterway of the Duwamish River, the Duwamish River and the West Waterway of the Duwamish River 2010 - 2014. Data collected in 2014 has higher reliability than previous years data.

wtrbdy	CSO	wet#10	wetvol10	CSO	wet#11	wetvol11	CSO	wet#12	wetvol12	CSO	wet#13	wetvol13	CSO	wet#14	wetvol14
EW	**107**	12	4,167,734	**107**	5	767,499	**99**	5	2,494,862	**107**	3	232,587	**99**	6	3,827,730
DR	**111**	3	7,724,604	**99**	3	715,775	**107**	4	352,041	**111**	3	11,507	**107**	6	288,804
WW	**99**	2	1,620,161	**111**	2	723	**111**	1	314,968	**99**	1	405,700	**111**	3	146,654

Red	highest number of events
Magenta	highest vol discharge
Yellow	other uncontrolled
Blue	controlled to 1 event
Light cyan	controlled to 0 events

Outfall 116 Removed

Outfall	Average Frequency	Average Volume (gal)
107	6	1,161,733
99	3.4	1,812,846
111	2.4	1,639,691

Waterbodies

EW	**East Waterway of the Duwamish River**
DR	**Duwamish River**
WW	**West Waterway of the Duwamish River**

Appendix A Table 6. Wet weather Combined Sewer Overflow events and volumes in Elliott Bay 2010 - 2014. Data collected in 2014 has higher reliability than previous years data.

wtrbdy	CSO	wet#03	wetvol03	CSO	wet#04	wetvol04	CSO	wet#05	wetvol05	CSO	wet#06	wetvol06	CSO	wet#07	wetvol07
EB	**71**	7	1,352,572	**71**	3	129,452	**71**	5	600,682	**71**	4	369,332	**69**	3	439,013
EB	**68**	1	1,840,469	**69**	2	57,940	**69**	2	277,093	**69**	3	439,013	**68**	2	188,263
EB	**69**	1	214,775	**70**	0	0	**68**	1	2,801,197	**68**	1	253,698	**71**	2	81,675
EB	**70**	0	0	**72**	0	0	**70**	0	0	**70**	1	65,550	**70**	0	0
EB	**72**	0	0	**68**	0	0	**72**	0	0	**72**	1	14,783	**72**	0	0
EB	**78**	0	0	**78**	0	0	**78**	0	0	**78**	0	0	**78**	0	0
EB	**80**	0	0	**80**	0	0	**80**	0	0	**80**	0	0	**80**	0	0

highest number of events

highest vol discharge

other uncontrolled

controlled to 1 event

controlled to 0 events

Outfall	Average frequency	Average Volume (gal)
71	4.2	506,743
69	2.2	285,567
68	1	1,016,725

Waterbodies

EB **Elliott Bay**

Appendix B
SPU PCMP

CSO NPDES Permitted Outfalls Physical Characteristics

Appendix B
SPU PCMP
CSO NPDES Permitted Outfalls Table 1 of 2
Physical Characteristics of Outfall and Receiving Water

			CSO Information										Infrastructure in Proximity to SPU CSO Outfall		Receiving Water - Physical Characteristics				
CSO Basin	Waterbody type (marine/lake/river/stream/estuary)	Receiving Water	NPDES Outfall #	Frequency of Overflow (avg per yr)[a]?	20-year Avg Overflow frequency (events per yr)a?	5-year Avg Overflow Volume (MG/year)	Currently monitored for water quality in ongoing CSO Characterization Study?[c]	2001 Reduction Plan Amendment Study Areas[d]	Projects listed in in NPDES permit under 'CSO permit compliance schedule'[d]	Projects Proposed in May 29, 2015 Integrated Plan	Diameter of CSO Outfall (in)[e]	Material of CSO Outfall[e]	Proximity to King County CSO(s) ft[f]	Proximity to SPU Stormwater Outfall(s) ftf	Discharges into an area with limited circulation & flushing?	Discharges into an area tidally influenced?	CSO outfall invert depth (feet)[e]	CSO outfall distance from Shoreline (ft)[e]	Slope and sediment character (physical) at outfall site
Windermere	fw lake	Lake Washington	12	<1	0.4	0.060	N	Y (N. Lake Wa/Windermere)			30	concrete	15200	Y	N	N	20	152	
Windermere	fw lake	Lake Washington	13	>5	10.1	5.130	Y	Y (N. Lake Wa/Windermere)	storage, windermere		36	wood stave	10800	270	N	N	27	500	
Windermere	fw lake	Lake Washington	14	<1	0.3	0.000	N	Y (N. Lake Wa/Windermere)			10	cast iron	9750	14	N	N	7	36	
Windermere	fw lake	Lake Washington	15	>=1 and <5	1.8	0.343	N	Y (N. Lake Wa/Windermere)	storage, windermere		30	wood stave	7800	270	N	N	22	278	
Windermere	fw lake	Lake Washington	16	<1	0.1	0.000	N				10	concrete	3700	1	N	N	on the shore	33	
Windermere	fw lake	Union Bay	18	>=1 and <5	4.3	6.695	Y			sewer system improvement, north union bay	60	concrete	1	1	Y	N	at surface (partially	5	
Windermere	fw lake	Union Bay	19	<1	0.2	0.000	N				48	concrete	925	770	Y	N	0.5	to Union Bay via	
Montlake/Madison Park	fw lake	Union Bay	20	>=1 and <5	1.6	0.733	N			sewer system Improvement and/or storage, montlake	21	concrete	1030	990	Y	N	2	10	
Montlake/Madison Park	fw lake	Union Bay	22	>=1 and <5	1.2	0.250	N				24	cast iron	5300	520	Y	N	4	0	
Leschi	fw lake	Lake Washington	24	>=1 and <5	1.0	0.709	N				20	cast iron	5800	510	N	N	8	240	
Leschi	fw lake	Lake Washington	25	<1	0.8	0.743	N				20	cast iron	5900	560	N	N	28	415	
Leschi	fw lake	Lake Washington	26[g]	N/A	N/A	N/A	N				8	cast iron	1700	70	N	N	26	204	
Leschi	fw lake	Lake Washington	27	<1	0.0	0.000	N				24	cast iron	1	1	N	N	31	286	
Leschi	fw lake	Lake Washington	28	>=1 and <5	3.1	0.003	Y			sewer system Improvement	16	cast iron	390	660	N	N	37	225	
Leschi	fw lake	Lake Washington	29	>=1 and <5	3.1	0.122	N			sewer system Improvement	15	cast iron	3000	400	N	N	26	264	
Leschi	fw lake	Lake Washington	30	>=1 and <5	1.0	0.123	N				48	corrugated aluminum	3300	1	N	N	9	122	
Leschi	fw lake	Lake Washington	31	>5	12.8	0.295	Y			sewer system Improvement and/or storage, leschi	8	Replaced Cast Iron outfall with HDPE and added flap gate Feb./2015	5500	210	N	N	12	82	
Leschi	fw lake	Lake Washington	32	>5	5.3	0.383	N			sewer system Improvement and/or storage, leschi	12	cast iron	7600	800	N	N	29	167	
Leschi	fw lake	Lake Washington	33	<1	0.3	0.000	N				20	cast iron	7600	450	N	N	30	70	
Leschi	fw lake	Lake Washington	34	>=1 and <5	1.1	0.229	N				16	cast iron	7100	450	N	N	30	72	
Leschi	fw lake	Lake Washington	35	>=1 and <5	1.0	0.002	N				15	cast iron	6300	440	N	N	24	220	
Leschi	fw lake	Lake Washington	36	>=1 and <5	2.2	0.070	N			sewer system Improvement and/or storage, leschi	21	corrugated metal	4800	1500	N	N	10	65	
Genesse	fw lake	Lake Washington	37[g]	N/A	N/A	N/A	N				12	corrugated metal	1400	20	N	N	6	32	
Genesse	fw lake	Lake Washington	38	<1	0.8	0.530	N				72; 36	concrete (72); reduces to cast iron (36)	1	225	N	N	37	396 (daylights 50' from shore)	
Genesse	fw lake	Lake Washington	39[g]	N/A	N/A	N/A	N	Y (S. Lake Wa / S. Genesee)			16	cast iron	120	120	N	N	27	297	
Genesse	fw lake	Lake Washington	40	>5	6.0	2.170	N	Y (S. Lake Wa / S. Genesee)	storage (genesee); BMPs		24; 12	concrete	1400	150	N	N	8	50	
Genesse	fw lake	Lake Washington	41	>5	8.9	1.410	Y	Y (S. Lake Wa / S. Genesee)			15; 14	amco iron (15in); PVC (14in)	1800	580	N	N	8	81	
Genessee	fw lake	Lake Washington	42	>=1 and <5	1.2	0.510	N	Y (S. Lake Wa / S. Genesee)	storage (genesee); BMPs		12	cast iron	4000	50	Y	N	9	165	
Genesse	fw lake	Lake Washington	43	>5	7.8	1.740	Y	Y (S. Lake Wa / S. Genesee)	storage (genesee)		21	RCP	4900	460	Y	N	12	70	
Henderson	fw lake	Lake Washington	44	>5	16.2	8.740	Y	Y (S. Lake Wa / S. Henderson)	storage (henderson); BMPs		24	wood stave	9000	370	Y	N	19	565	
Henderson	fw lake	Lake Washington	45	>5	14.6	0.630	N	Y (S. Lake Wa / S. Henderson)	storage (henderson); BMPs		30	concrete	7200	360	N	N	3.5	74	
Henderson	fw lake	Lake Washington	46	>5	7.4	0.870	N	Y (S. Lake Wa / S. Henderson)	storage (henderson)		12	concrete	2900	210	N	N	9	165	
Henderson	fw lake	Lake Washington	47	>5	16.2	5.360	Y	Y (S. Lake Wa / S. Henderson)	storage (henderson); BMPs		84	concrete	1	25	Y	N	8	34	
Henderson	fw lake	Lake Washington	48	<1	0.0	0.000	N	Y (S. Lake Wa / S. Henderson)			24	ductile iron	3500	1350	N	N	16	38	
Henderson	fw lake	Lake Washington	49	>=1 and <5	2.7	2.140	N	Y (S. Lake Wa / S. Henderson)	storage (henderson); BMPs		21	PVC	4800	200	N	N	0.5	0.5	
Ballard	marine	Puget Sound-Central	56[g]	N/A	N/A	N/A	N				8	cast iron	11000	350	N	Y	above water at time of inspection	0.5	
Ballard	marine	Puget Sound-Central	57	<1	0.0	0.000	N				8	cast iron	10000	1	N	Y	above water at time of inspection	1	
Ballard	marine	Salmon Bay	59	<1	0.4	0.020	N				36	cast iron	6600	760	Y	Y	20	108	
Ballard	marine	Salmon Bay	60	>=1 and <5	2.8	0.300	N			sewer system improvement and/or storage, magnolia	20	cast iron	6200	1600	Y	Y	20	217	
Magnolia	marine	Elliott Bay	61	<1	0.1	0.000	N	Y (Puget Sound/Magnolia)			12	ductile iron	6700	370	N	Y	14	351	
Magnolia	marine	Elliott Bay	62	<1	0.9	0.000	N	Y (Puget Sound/Magnolia)			30	concrete	6600	450	N	Y	12	302	
Magnolia	marine	Elliott Bay	63[g]	N/A	N/A	N/A	N	Y (Puget Sound/Magnolia)			12	cast iron	6400	1	N	Y	35	1205	
Magnolia	marine	Elliott Bay	64	<1	0.0	0.000	N	Y (Puget Sound/Magnolia)			12	cast iron	1	260	N	Y	10	275	
Magnolia/Interbay	marine	Elliott Bay	68	<1	0.8	1.030	N				96	concrete	5000	1	Y	Y	4	0	
Vine Street	marine	Elliott Bay	69	>=1 and <5	1.8	0.240	N			storage, central waterfront	24	cast iron	2800	790	Y	Y	12	12	
King Street	marine	Elliott Bay	70	<1	0.5	0.010	N				24	concrete	2600	1	Y	Y	21	5	
University Street	marine	Elliott Bay	71	>=1 and <5	2.4	0.510	Y		storage (central waterfront)		60	RCP	1700	210	Y	Y	2	0	
University Street	marine	Elliott Bay	72	<1	0.4	0.000	N				24	cast iron	690	750	Y	Y	23	157	
West Seattle	marine	Elliott Bay	78	<1	0.2	0.000	N				42	concrete	7900	660	N	Y	17	128	
West Seattle	marine	Elliott Bay	80	<1	0.0	0.000	N				18	concrete	6900	420	N	Y	15	15	
West Seattle	marine	Puget Sound-Central	83	<1	0.0	0.000	N				16; 20	vitrified clay (16in); cast iron (20 in)	3200	414	N	Y	11	322	
West Seattle	marine	Puget Sound-Central	85	<1	0.0	0.000	N				6	concrete	2500	950	N	Y	0	0	
West Seattle	marine	Puget Sound-Central	88	<1	0.3	0.070	N				18	steel	2000	670	N	Y	0	1	
West Seattle	marine	Puget Sound-Central	90	<1	0.1	0.000	N				24	cast iron	1	220	N	Y	22	593	
West Seattle	marine	Puget Sound-Central	91	<1	0.0	0.000	N				24	ductile iron	700	660	N	Y	8	233	
West Seattle	marine	Puget Sound-Central	94	<1	0.1	0.000	N				24; 16	ductile iron	1	144	N	Y	40	570	
West Seattle	marine	Puget Sound-Central	95	>=1 and <5	2.4	0.040	N				10	ductile iron	1300	1200	N	Y	8	110	

Appendix B
SPU PCMP
CSO NPDES Permitted Outfalls Table 1 of 2
Physical Characteristics of Outfall and Receiving Water

			CSO Information										Infrastructure in Proximity to SPU CSO Outfall		Receiving Water - Physical Characteristics				
CSO Basin	Waterbody type (marine/lake/river/stream/estuary	Receiving Water	NPDES Outfall #	Frequency of Overflow (avg per yr)[a]?	20-year Avg Overflow frequency (events per yr)a?	5-year Avg Overflow Volume (MG/year)	Currently monitored for water quality in ongoing CSO Characterization Study?[c]	2001 Reduction Plan Amendment Study Areas[d]	Projects listed in in NPDES permit under 'CSO permit compliance schedule'[d]	Projects Proposed in May 29, 2015 Integrated Plan	Diameter of CSO Outfall (in)[e]	Material of CSO Outfall[e]	Proximity to King County CSO(s) ft[f]	Proximity to SPU Stormwater Outfall(s) ftf	Discharges into an area with limited circulation & flushing?	Discharges into an area tidally influenced?	CSO outfall invert depth (feet)[e]	CSO outfall distance from Shoreline (ft)[e]	Slope and sediment character (physical) at outfall site
Delridge	river	W Waterway of Duwamish River	99	>=1 and <5	1.9	1.810	Y			sewer system improvement and/or storage , Delridge	96	concrete	1	1200	Y	Y	0	0	
Duwamish	river	East Waterway of Duwamish River	107	>5	5.1	1.160	N			sewer system improvement and/or storage, east waterway	54	RCP	1300	280	Y	Y	5	0	
Duwamish	river	Duwamish River	111	>=1 and <5	2.0	1.640	Y	Y (Duwamish R / Diagonal)	storage (duwamish)	sewer system improvement and/or storage, duwamish	144	concrete	1	830	Y	Y	0	0	
Duwamish	river	Duwamish River	116[g]	N/A	N/A	N/A	N				30	vitrified clay	750	1200	Y	Y	0	0	
Lake Union	fw lake	Lake Union / Ship Canal	120	<1	0.0	0.000	N				8	cast iron	3600	330	Y	N	9	16	
Lake Union	fw lake	Lake Union / Ship Canal	121	<1	0.1	0.000	N				8	cast iron	2100	1200	Y	N	4	24	
Lake Union	fw lake	Lake Union / Ship Canal	124	<1	0.0	0.000	N				10	cast iron	1700	200	Y	N	6	16	
Lake Union	fw lake	Lake Union / Ship Canal	127	<1	0.4	0.000	N				8	cast iron	2200	47	Y	N	10	18	
Madison Valley/Lake	fw lake	Lake Union / Ship Canal	129	<1	0.2	0.010	N				8	concrete	2900	400	Y	N	0	3	
Madison Valley/Lake	fw lake	Lake Union / Ship Canal	130	<1	0.0	0.000	N				21	RCP	3400	500	Y	N	29	157	
Madison Valley/Lake	fw lake	Lake Union / Ship Canal	131	<1	0.1	0.000	N				8	cast iron	4250	3500	Y	N	17	104	
Madison Valley/Lake	fw lake	Lake Union / Ship Canal	132	<1	0.4	0.000	N				30	corrugated aluminum	4700	900	Y	N	3.5	1.5	
Lake Union	fw lake	Lake Union / Ship Canal	134	<1	0.0	0.000	N				8	ductile iron	4400	14	Y	N	2	2	
Montlake	fw lake	Lake Union / Ship Canal	135	<1	0.1	0.000	N				10	steel	2600	720	Y	N	0.5	5	
Montlake	fw lake	Lake Union / Ship Canal	136	<1	0.0	0.000	N				8	cast iron	1500	1300	Y	N	0	0	
Montlake	fw lake	Portage Bay	138	>=1 and <5	1.7	0.450	N			sewer system improvement and/or storage, portage bay	16	wood stave	1350	1350	Y	N	6	148	
Montlake	fw lake	Portage Bay	139	>=1 and <5	1.3	0.160	N			sewer system improvement and/or storage, montlake	42	HDPE	2200	1100	Y	N	4	50	
Montlake	fw lake	Portage Bay	140	>=1 and <5	4.4	0.340	N			sewer system improvement and/or storage, montlake	18	cast iron	850	1100	Y	N	3	22	
Montlake	fw lake	Portage Bay	141	<1	0.1	0.000	N				18	RCP	1200	318	Y	N	20	324	
Lake Union	fw lake	Lake Union	144	<1	0.1	0.000	N				18	concrete	3800	250	Y	N	8	96	
Lake Union	fw lake	Lake Union	145	<1	0.0	0.000	N				36	corrugated metal	5200	400	Y	N	9	189	
Lake Union	fw lake	Lake Union	146	<1	0.0	0.000	N				8	cast iron	5100	500	Y	N	3	1	
Fremont	fw lake	Lake Union	147	>5	38.9	12.940	Y		weir modification, monitoring	storage, wallingford	30	concrete	4100	920	Y	N	5	10	
Fremont	fw lake	Ship Canal	148	<1	0.2	0.010	N				12	cast iron	1400	950	Y	N	7	5	
Ballard	fw lake	Salmon Bay	152	>5	46.1	37.530	Y		storage, monitoring, modeling	storage, ballard	48	wood stave	2900	550	Y	N	10	60	
Windermere	fw lake	Lake Washington	161	<1	0.0	0.000	N				42	corrugated metal	17200	1	N	N	6	47	
Genesse	fw lake	Lake Washington	165	>=1 and <5	1.1	0.000	N	Y (S. Lake Wa / S. Genesee)	storage (genesee)		12	RCP	4300	460	Y	N	6	43	
Delridge	fw stream	Longfellow Creek	168	>=1 and <5	2.5	2.260	N	Y (Longfellow Cr / Delridge)		sewer system improvement and/or storage, delridge	36	concrete	13700	200	Y	N	0.5	0	
Delridge	fw stream	Longfellow Creek	169	>=1 and <5	2.4	2.140	Y	Y (Longfellow Cr / Delridge)		sewer system improvement and/or storage, delridge	42	corrugated metal	1400	1	Y	N	0.5	0	
Delridge	fw stream	Longfellow Creek	170	<1	0.6	0.010	N				48	concrete	1500	1300	Y	N	0.5	0	
Henderson	fw lake	Lake Washington	171	>5	7.6	1.780	N	Y (S. Lake Wa / S. Henderson)	storage (henderson); BMPs		36	concrete	1200	1200	Y	N	6	0	
Fremont	fw lake	Ship Canal	174	>5	9.5	7.510	Y		partial separation, monitoring	storage, fremont	12	steel	525	340	Y	N	0.5	0	
Madison Valley/Lake	fw lake	Lake Union / Ship Canal	175	<1	0.4	0.000	N				52	corrugated metal	3000	280	Y	N	12	59	
Ballard	fw lake	Salmon Bay	150/151	>5	18.4	3.100	Y		storage, monitoring, modeling (ballard)	storage, ballard	30; 18 (two outlets)	wood stave (two pipes). Replaced outfall 150 with HDPE December 2014.	5200	1160	Y	N	3; 12	60; 175	

NOTES:
[a] Average annual overflow frequency (1995 through 2014, from annual reports)
[b] Average annual overflow volume (2010-2014, from annual reports)
[c] Study location identified by SPU in the CSO Supplemental Characterization Study; locations prioritized for monitoring based on criteria including CSO duration and frequency, representation of all 5 receiving waters and land use within the CSO service area, and suitability for monitoring access and equipment.
[d] From SPU NPDES CSO permit dated 12/1/05 through 11/30/10 (*note: list of projects on compliance schedule from Table 4 of permit, with "Monitoring and Planning" meaning flow monitoring in support of planning and design of facilities.*)
[e] Information from Herrera 2006 (Outfall characterization study); physical characteristics of outfall pipe
[f] From SPU GIS
[g] Outfall Sealed - No longer active.

Appendix B
SPU PCMP
CSO NPDES Permitted Outfalls Table 2 of 2
Receiving Water and Sediment Characteristics

			CSO Information			Receiving Water - Uses, Sensitive Areas, Impairments				303d listings (2008)[h]					Existing Information - Water Column and/or Sediments	
CSO Basin	Waterbody type (marine/lake/river/stream/estuary	Receiving Water	NPDES Outfall #	Frequency of Overflow (avg per yr)[a]?	Avg Vol of Overflow (MG per yr)[b]?	Distance to closest beach (ft)[f]	Distance to Closest Boat Ramp or Marina (ft)f	Distance to Closest Waterfront Park (ft)[f]	Discharges into a sensitive habitat?	303d listings	listing number	medium	parameter(s)	Outfall in proximity to a Superfund or other site (MOTCA or planned PRP cleanup site)?	In proximity to sediment monitoring station?	In proximity to King County lake or puget sound water quality monitoring station?
Windermere	fw lake	Lake Washington	12	<1	0.1	3,600	1,700	973	Y (ESA Chinook Critical Habitat)							
Windermere	fw lake	Lake Washington	13	>5	5.1	450	5,762	450	Y (ESA Chinook Critical Habitat)							
Windermere	fw lake	Lake Washington	14	<1	0.0	1,900	7,350	1,900	Y (ESA Chinook Critical Habitat)							
Windermere	fw lake	Lake Washington	15	>=1 and <5	0.3	310	9,411	0	Y (ESA Chinook Critical Habitat)							
Windermere	fw lake	Lake Washington	16	<1	0.0	6,250	1,500	2,300	Y (ESA Chinook Critical Habitat)	2	11960	water	ammonia-N			
Windermere	fw lake	Union Bay	18	>=1 and <5	6.7	7,550	1,500	0	Y (ESA Chinook Critical Habitat)	no data						
Windermere	fw lake	Union Bay	19	<1	0.0	11,200	3,430	0	Y (ESA Chinook Critical Habitat)	4C	4676	habitat	invasive spp			
Montlake/Madison Park	fw lake	Union Bay	20	>=1 and <5	0.7	9,070	2,275	0	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake/Madison Park	fw lake	Union Bay	22	>=1 and <5	0.3	3,900	3,450	700	Y (ESA Chinook Critical Habitat)	2	11960	water	ammonia-N			
Leschi	fw lake	Lake Washington	24	>=1 and <5	0.7	1,491	2,206	1,500	Y (ESA Chinook Critical Habitat)							
Leschi	fw lake	Lake Washington	25	<1	0.7	1,522	2,220	1,450	Y (ESA Chinook Critical Habitat)							
Leschi	fw lake	Lake Washington	26[g]	N/A	N/A	900	6,300	900	Y (ESA Chinook Critical Habitat)	1	12317	water	PCB			
Leschi	fw lake	Lake Washington	27	<1	0.0	2,375	8,070	0	Y (ESA Chinook Critical Habitat)	1	12317	water	PCB			
Leschi	fw lake	Lake Washington	28	>=1 and <5	0.0	1,950	8,472	0	Y (ESA Chinook Critical Habitat)	1	12317	water	PCB			
Leschi	fw lake	Lake Washington	29	>=1 and <5	0.1	717	671	0	Y (ESA Chinook Critical Habitat)	1	12207	water	fecal coliform			
Leschi	fw lake	Lake Washington	30	>=1 and <5	0.1	1,100	250	0	Y (ESA Chinook Critical Habitat)	1	12207	water	fecal coliform			
Leschi	fw lake	Lake Washington	31	>5	0.3	3,180	0	0	Y (ESA Chinook Critical Habitat)	1	12207	water	fecal coliform			
Leschi	fw lake	Lake Washington	32	>5	0.4	3,200	2,000	1,670	Y (ESA Chinook Critical Habitat)							
Leschi	fw lake	Lake Washington	33	<1	0.0	4,200	1,700	1,300	Y (ESA Chinook Critical Habitat)							
Leschi	fw lake	Lake Washington	34	>=1 and <5	0.2	8,000	1,650	1,270	Y (ESA Chinook Critical Habitat)							
Leschi	fw lake	Lake Washington	35	>=1 and <5	0.0	4,700	1,000	460	Y (ESA Chinook Critical Habitat)	5	12188	water	fecal coliform			
Leschi	fw lake	Lake Washington	36	>=1 and <5	0.1	370	2,700	0	Y (ESA Chinook Critical Habitat)	5	12188	water	fecal coliform			
Genesse	fw lake	Lake Washington	37[g]	N/A	N/A	3,700	1,200	50	Y (ESA Chinook Critical Habitat)	2	500006 (s), 12314 (w)	sediment / water	sediment bioassay, PCB (w)			
Genesse	fw lake	Lake Washington	38	<1	0.5	5,200	400	0	Y (ESA Chinook Critical Habitat)	2	12314	water	PCB			
Genesse	fw lake	Lake Washington	39[g]	N/A	N/A	5,200	400	0	Y (ESA Chinook Critical Habitat)	2	12314	water	PCB			
Genesse	fw lake	Lake Washington	40	>5	2.2	7,000	1,650	0	Y (ESA Chinook Critical Habitat)	2	12314	water	PCB			
Genesse	fw lake	Lake Washington	41	>5	1.4	7,100	2,000	0	Y (ESA Chinook Critical Habitat)	2	12314	water	PCB			
Genessee	fw lake	Lake Washington	42	>=1 and <5	0.5	4,500	0	0	Y (ESA Chinook Critical Habitat)							
Genesse	fw lake	Lake Washington	43	>5	1.7	3,600	1,000	0	Y (ESA Chinook Critical Habitat)	5	12184	water	fecal coliform			
Henderson	fw lake	Lake Washington	44	>5	8.7	12,100	2,100	0	Y (ESA Chinook Critical Habitat)							
Henderson	fw lake	Lake Washington	45	>5	0.6	4,400	250	0	Y (ESA Chinook Critical Habitat)	5	12205	water	fecal coliform			
Henderson	fw lake	Lake Washington	46	>5	0.9	350	3,100	0	Y (ESA Chinook Critical Habitat)	5	12205	water	fecal coliform			
Henderson	fw lake	Lake Washington	47	>5	5.4	3,500	0	0	Y (ESA Chinook Critical Habitat)	5	12204	water	fecal coliform			
Henderson	fw lake	Lake Washington	48	<1	0.0	5,600	2,400	1,600	Y (ESA Chinook Critical Habitat)	5	51593, 52705	tissue	2,3,7,8-TCDD, PCB			
Henderson	fw lake	Lake Washington	49	>=1 and <5	2.1	6,900	3,600	2,800	Y (ESA Chinook Critical Habitat)	5	51593, 52705	tissue	2,3,7,8-TCDD, PCB			
Ballard	marine	Puget Sound-Central	56[g]	N/A	N/A	2,400	0	2,200	Y (ESA Orca Critical Habitat; Chinook	5	42491	water	fecal coliform			
Ballard	marine	Puget Sound-Central	57	<1	0.0	3,400	0	1,700	Y (ESA Orca Critical Habitat; Chinook	5	42491	water	fecal coliform			
Ballard	marine	Salmon Bay	59	<1	0.0	7,700	2,500	600	Y (ESA Chinook Critical Habitat)	5	42491	water	fecal coliform			
Ballard	marine	Salmon Bay	60	>=1 and <5	0.3	8,700	3,300	1,200	Y (ESA Chinook Critical Habitat)	5	42491	water	fecal coliform			
Magnolia	marine	Elliott Bay	61	<1	0.0	6,700	6,200	0	Y (ESA Orca Critical Habitat; Chinook	1	512066-73-81-83-84-93	sediment	multiple metals, 4-methylphenol,			
Magnolia	marine	Elliott Bay	62	<1	0.0	8,000	5,800	0	Y (ESA Orca Critical Habitat; Chinook	1	512066-73-81-83-84-93	sediment	multiple metals, 4-methylphenol,			
Magnolia	marine	Elliott Bay	63[g]	N/A	N/A	8,550	6,100	0	Y (ESA Orca Critical Habitat; Chinook	1	512066-73-81-83-84-93	sediment	multiple metals, 4-methylphenol,			
Magnolia	marine	Elliott Bay	64	<1	0.0	14,000	300	0	Y (ESA Orca Critical Habitat; Chinook	2	512133-41-69	sediement	2,4,dimethylphenol, hexachlorobutadiene, N-			
Magnolia/Interbay	marine	Elliott Bay	68	<1	1.0	15,000	0	0	Y (ESA Orca Critical Habitat; Chinook	2	45583	water	fecal coliform			
Vine Street	marine	Elliott Bay	69	>=1 and <5	0.2	15,000	8,400	1,900	Y (ESA Orca Critical Habitat; Chinook	2	15801	water	endosulfan			
King Street	marine	Elliott Bay	70	<1	0.0	15,000	14,000	230	Y (ESA Orca Critical Habitat; Chinook	5	505989	sediment / water	sediment bioassay/ wtr fecal coliform			
University Street	marine	Elliott Bay	71	>=1 and <5	0.5	11,000	11,000	2,000	Y (ESA Orca Critical Habitat; Chinook	5	505989	sediment / water	sediment bioassay/ wtr fecal coliform			
University Street	marine	Elliott Bay	72	<1	0.0	10,000	11,000	2,400	Y (ESA Orca Critical Habitat; Chinook	5	505989	sediment / water	sediment bioassay/ wtr fecal coliform			
West Seattle	marine	Elliott Bay	78	<1	0.0	150	150	0	Y (ESA Orca Critical Habitat; Chinook	5	45102	water	fecal coliform			
West Seattle	marine	Elliott Bay	80	<1	0.0	600	130	0	Y (ESA Orca Critical Habitat; Chinook	5	45557	water	fecal coliform			
West Seattle	marine	Puget Sound-Central	83	<1	0.0	200	4,100	0	Y (ESA Orca Critical Habitat; Chinook	5	45557	water	fecal coliform			
West Seattle	marine	Puget Sound-Central	85	<1	0.0	0	1,400	1,100	Y (ESA Orca Critical Habitat; Chinook	5, 1	15805, 42482	water	fecal coliform, DO			
West Seattle	marine	Puget Sound-Central	88	<1	0.1	0	5,700	2,300	Y (ESA Orca Critical Habitat; Chinook	1	21695	habitat	fish hab			
West Seattle	marine	Puget Sound-Central	90	<1	0.0	300	300	200	Y (ESA Orca Critical Habitat; Chinook	2(s), 5(w)	50844-50-57-83-85(s),	sediment / water	Hg, 2,4-D, dibenzo[a,h]anthracene,			
West Seattle	marine	Puget Sound-Central	91	<1	0.0	100	100	0	Y (ESA Orca Critical Habitat; Chinook	5	6654	water	fecal coliform			
West Seattle	marine	Puget Sound-Central	94	<1	0.0	900	900	900	Y (ESA Orca Critical Habitat; Chinook	5	6654	water	fecal coliform			
West Seattle	marine	Puget Sound-Central	95	>=1 and <5	0.0	170	1,900	1,900	Y (ESA Orca Critical Habitat; Chinook	5	6654	water	fecal coliform			
Delridge	fw stream	W Waterway of Duwamish River	99	>=1 and <5	1.8	5,200	2,700	5,700	Y (Spawning and documented presence of salmonids, incl. coho- WDFW online data)	5	7491	water	fecal coliform			
Duwamish	river	East Waterway of Duwamish River	107	>5	1.2	11,000	1,800	5,700	Y (ESA Chinook Nearshore Marine Critical Habitat; other salmonids documented presence)	2	50701(+)	sediment	organics (multiple)	superfund		
Duwamish	river	Duwamish River	111	>=1 and <5	1.6	10,000	2,000	600	Y (ESA Chinook Nearshore Marine Critical Habitat; other salmonids documented presence)	5	507660, 48944, 8650	sediment / water	sediment bioassay, DO, bis(2-ethylhexyl)pthalate	superfund		
Duwamish	river	Duwamish River	116[g]	N/A	N/A	15,000	4,600	4,600	Y (ESA Chinook Nearshore Marine Critical Habitat; other salmonids documented presence)	5	superfund			superfund		

Appendix B
SPU PCMP
CSO NPDES Permitted Outfalls Table 2 of 2
Receiving Water and Sediment Characteristics

			CSO Information			Receiving Water - Uses, Sensitive Areas, Impairments									Existing Information - Water Column and/or Sediments	
										303d listings (2008)[h]						
CSO Basin	Waterbody type (marine/lake/river/stream/estuary	Receiving Water	NPDES Outfall #	Frequency of Overflow (avg per yr)[a]?	Avg Vol of Overflow (MG per yr)[b]?	Distance to closest beach (ft)[f]	Distance to Closest Boat Ramp or Marina (ft)f	Distance to Closest Waterfront Park (ft)[f]	Discharges into a sensitive habitat?	303d listings	listing number	medium	parameter(s)	Outfall in proximity to a Superfund or other site (MOTCA or planned PRP cleanup site)?	In proximity to sediment monitoring station?	In proximity to King County lake or puget sound water quality monitoring station?
Lake Union	fw lake	Lake Union	120	<1	0.0	na	0	1,700	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Lake Union	fw lake	Lake Union	121	<1	0.0	na	0	2,400	Y (ESA Chinook Critical Habitat)	2(sediment) 5 (water)	500017(s), 52866, 8066,	sediment / water	sediment bioassay, total phosphorus, Pb, fecal			
Lake Union	fw lake	Lake Union	124	<1	0.0	na	0	0	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Lake Union	fw lake	Lake Union	127	<1	0.0	na	650	0	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Madison Valley/Lake	fw lake	Lake Union	129	<1	0.0	na	0	1,000	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Madison Valley/Lake	fw lake	Lake Union	130	<1	0.0	na	1,000	175	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Madison Valley/Lake	fw lake	Lake Union	131	<1	0.0	na	0	400	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Madison Valley/Lake	fw lake	Lake Union	132	<1	0.0	na	0	0	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Lake Union	fw lake	Lake Union	134	<1	0.0	na	0	350	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Lake Union	135	<1	0.0	na	0	250	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Lake Union	136	<1	0.0	na	0	1,200	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Portage Bay	138	>=1 and <5	0.5	na	0	1,000	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Portage Bay	139	>=1 and <5	0.2	na	700	0	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Portage Bay	140	>=1 and <5	0.3	na	2,000	250	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Montlake	fw lake	Portage Bay	141	<1	0.0	na	70	300	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Lake Union	fw lake	Lake Union	144	<1	0.0	na	0	700	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Lake Union	fw lake	Lake Union	145	<1	0.0	na	0	0	Y (ESA Chinook Critical Habitat)	2(sediment) 5 (water)	500017(s), 52866, 8066,	sediment / water	sediment bioassay, total phosphorus, Pb, fecal			
Lake Union	fw lake	Lake Union	146	<1	0.0	na	0	880	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	sediment / water	sediment bioassay, total phosphorus, Pb, fecal			
Fremont	fw lake	Lake Union	147	>5	12.9	na	0	1,600	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	sediment / water	sediment bioassay, total phosphorus, Pb, fecal			
Fremont	fw lake	Ship Canal	148	<1	0.0	na	300	1,800	Y (ESA Chinook Critical Habitat)	1	52843	water	total phosphorus			
Ballard	fw lake	Salmon Bay	152	>5	37.5	na	0	1,400	Y (ESA Chinook Critical Habitat)	1	52843	water	total phosphorus			
Windermere	fw lake	Lake Washington	161	<1	0.0	1,300	260	0	Y (ESA Chinook Critical Habitat)	5	12191	water	fecal coliform			
Genesse	fw lake	Lake Washington	165	>=1 and <5	0.0	2,800	900	0	Y (ESA Chinook Critical Habitat)	5	12184	water	fecal coliform			
Delridge	fw stream	Longfellow Creek	168	>=1 and <5	2.3	na	na	na	Y (Spawning and documented presence of salmonids, incl. coho- WDFW online data)	5	7491	water	fecal coliform			
Delridge	fw stream	Longfellow Creek	169	>=1 and <5	2.1	na	na	na	Y (Spawning and documented presence of salmonids, incl. coho- WDFW online data)	5	7491	water	fecal coliform			
Delridge	fw stream	Longfellow Creek	170	<1	0.0	na	na	na	Y (Spawning and documented presence of salmonids, incl. coho- WDFW online data)	5	7491	water	fecal coliform			
Henderson	fw lake	Lake Washington	171	>5	1.8	3,700	0	0	Y (ESA Chinook Critical Habitat)	5	12204	water	fecal coliform			
Fremont	fw lake	Ship Canal	174	>5	7.5	na	500	75	Y (ESA Chinook Critical Habitat)	1	52843	water	total phosphorus			
Madison Valley/Lake	fw lake	Lake Union	175	<1	0.0	na	0	2,200	Y (ESA Chinook Critical Habitat)	5	52866, 8066, 12172, 11918	water	total phosphorus, Pb, fecal coliform, aldrin			
Ballard	fw lake	Salmon Bay	150/151	>5	3.1	na	0	2,600	Y (ESA Chinook Critical Habitat)	1	52843	water	total phosphorus			

NOTES:

[a] Average annual overflow frequency (1995 through 2014, from annual reports)

[b] Average annual overflow volume (2010-2014, from annual reports)

[f] From SPU GIS

[g] Outfall Sealed - No longer active.

[h] 303(d) data fron http://apps.ecy.wa.gov/wqawa2008/viewer.htm