Combined Sewer Overflow Control Program

2014 Annual CSO and Consent Decree Report

July 2015

King County

Protecting Our Waters

Doing our part on rainy days

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1.0 Introduction

King County's (County) Wastewater Treatment Division (WTD) is responsible for managing the regional wastewater system. WTD prepares annual reports on its combined sewer overflow (CSO) control program to fulfill requirements under the National Pollutant Discharge Elimination (NPDES) permit for the County's West Point Treatment Plant (WA0029181) in Seattle and requirements in Washington Administrative Code (WAC) 173-245-090. King County submits these reports to the Washington State Department of Ecology (Ecology).

On July 3, 2013, a Consent Decree (CD), Civil Action No. 2:13-cv-677, between the United States Department of Justice (DOJ), United States Environmental Protection Agency (EPA), Ecology, and King County was finalized. Section VIII of the CD requires submittal of an annual report detailing implementation of the CD. With the agreement of EPA and Ecology, beginning with the 2014 Annual Report, the CSO and CD annual reports were consolidated into one report. This annual report meets the CD, WAC, and NPDES requirements.

CSO control is important to King County because CSOs are a recognized source of water pollution that can result in temporary increases in bacterial counts, aesthetic degradation of shorelines, long-term adverse effects on sediment quality at discharge points, and raised public health concerns in areas where there is potential for public contact. Compliance with regulations, the NPDES permit, and the CD is a top priority for King County. The County is committed to meeting all the milestones and actions outlined in the CD. WTD is providing its staff ongoing trainings, briefings, and division-wide communication on the CD to ensure everyone works together to achieve these priorities. As a result, all the projects and plans outlined in the CD are currently on schedule to achieve their critical milestones.

This report documents CSO control program activities and information for 2014 on the following topics:

- Implementation of early action and long-term CSO control plan measures
- CSO volumes and frequency of overflows (including overflow durations and associated rainfall data)
- Information on any CSO-related bypasses at the West Point Treatment Plant
- Information on any dry weather overflows (DWO)
- Sewer Systems Operations Plan (SSOP) implementation
- Development of the Joint Operations and System Optimization Plan (Joint Plan) between the City of Seattle and King County
- Coordination between King County and the City of Seattle on CSO Control projects
- NPDES permit compliance for the King County CSO treatment plants.

The annual rainfall for 2014, as an average over local rain gauges, was 42.24 inches, which is higher than the 20-year Seattle-Tacoma International Airport (Sea-Tac) annual average of 37.27 inches. The wettest months at the local rain gauges were March (7.64 inches) and October (5.9 inches). Hydraulic modeling predicts that King County CSOs will discharge 800 million gallons (MG) of untreated CSO in an average

year of rainfall. In 2014, there were 44 days of rain that resulted in untreated CSO discharges; sometimes there were multiple discharges on the same date. Conditions in 2014 resulted in 388 untreated events discharging 1,140 MG and 60 treated CSO events discharging 776 MG.

The following sections provide background on King County's wastewater system, its CSO control program, and CD requirements.

1.1 King County CSO Locations

King County provides wholesale wastewater conveyance and treatment of flows from 17 cities, 16 local sewer utilities, and 1 tribal government.

The City of Seattle's local wastewater collection system contains combined sewers that collect both wastewater and stormwater. Other newer local systems use separate sewers to convey wastewater and stormwater. Seattle's combined sewers convey flows to King County trunks and interceptors, which convey flows to the West Point Treatment Plant in Seattle's Discovery Park. A small portion of flows from the combined system are treated at the South Treatment Plant in Renton. King County's responsibility for sewerage facilities begins at the point where 1,000 acres of drainage come together.

When large storms occur and flows exceed the capacity of County conveyance system facilities, CSOs may occur at any of the 38 County CSO locations that discharge to Lake Washington, Lake Union, the Lake Washington Ship Canal, the Duwamish River, Elliott Bay, and Puget Sound (Figure 1). Some of these 38 CSO locations have multiple discharge points. Additional monitoring and research is being performed in 2015 to identify how many total discharge locations exist. These changes will be documented in the 2015 CSO Annual Report.

CSOs also may occur at the City of Seattle's 87 CSO locations in their local sewer system. The City is responsible for managing and reporting on those locations.

1.2 CSO Control Plans, Amendments, and Updates

Since the 1970s, when the basic regional wastewater system infrastructure was in place, the Municipality of Metropolitan Seattle (Metro) and its successor, King County, have been implementing CSO control projects to improve water quality in the Seattle area. King County does this under a CSO Control Plan that is amended or updated with each renewal of the West Point Treatment Plant's NPDES permit. Ahead of each CSO Control Plan update, the County reviews the plan, progress toward CSO control, and its program in general against conditions that may have changed since the last update—conditions such as flow patterns, scientific developments, changed regulations, new technologies, and public priorities. Significant change may require adjustment of the CSO Control Plan.

The West Point Treatment Plant NPDES permit was renewed on December 19, 2014 and became effective on February 1, 2015. The renewed permit contains new requirements for aspects of the CSO control program, which will be addressed starting in 2015. Some of the new changes will include:

King County Combined Sewer Overflow (CSO) Locations with Wastewater Pipelines

- King County CSO
- CSO Treatment Plant/Facility
- Wastewater Treatment Plant
- Wastewater Pipeline
- Wastewater Tunnel Section
- CSO Tunnel
- City of Seattle CSO
- Park

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

N
0 1/2 1 Mile
June 2011

Data: King County WTD
File Name: 1106CSOmap_lines.ai wgsb

Figure 1. King County CSO Locations

- The four CSO treatment plants with settleable solids standards will be assessed annually instead of on an annual and per-event basis as in the previous permit.
- For the Elliott West CSO treatment plant, the limits for total residual chlorine increased slightly from a maximum daily average of 104 to 109 micrograms per liter (µg/L), due to a change in mixing dilution. Fecal coliform limits were revised from a monthly geomean limit of 154 counts per 100 milliliters (counts/100 ml) (with non-discharge days calculated in the monthly geomean as '1') to a performance-based monthly geomean limit of 400 counts/100 ml, matching all the other CSO treatment facilities. The new permit also includes additional monitoring for dissolved oxygen, copper and cyanide, and requires a study to evaluate options for reducing copper and settleable solids concentrations.
- For the Henderson/MLK CSO treatment plant, copper monitoring is required for each event and polychlorinated biphenyls (PCB) monitoring is required using EPA method 1668 with a method detection limit of 0.0001 µg/L.

1.2.1 CSO Control Plans, 1979-2008

Metro first formalized CSO control with the development of the *1979 CSO Control Program* (1979 Program), which was developed in cooperation with EPA and the City of Seattle. The 1979 Program identified nine Metro projects to reduce the number of CSO events into fresh water (Lake Washington, Lake Union, and the Lake Washington Ship Canal). In 1985, the Washington State Water Pollution Control Act (Chapter 90.48 RCW) introduced new regulations that required all municipalities with CSOs to develop plans for "the greatest reasonable reduction at the earliest possible date." Metro prepared the *1986 Final Supplemental Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control* (1986 Plan) to meet this requirement.

Before the 1986 Plan could be implemented, Ecology promulgated new regulations (WAC 173-245-020) that defined "greatest reasonable reduction" to mean "control of each CSO such that an average of one untreated discharge may occur per year." Metro worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes system-wide by the end of 2005. Metro's *Final 1988 Combined Sewer Overflow Control Plan* (1988 Plan) identified 11 CSO control projects designed to meet this interim goal.

King County took over responsibility for operating and maintaining the regional wastewater system in 1994. As part of the 1995 NPDES permit renewal for the West Point Treatment Plant, King County prepared an update and amendment to the 1988 Plan. The *1995 CSO Control Plan Update* (1995 Plan Update) assessed the effectiveness of CSO reduction efforts to date, reevaluated priorities for control of CSO sites, and identified three control projects for completion in 1995–2000.

In the late 1990s, King County developed a major update to its comprehensive sewerage plan called the *1999 Regional Wastewater Services Plan* (RWSP). During that period, Ecology agreed to discontinue the 75% volume reduction interim target for County CSO control to allow prioritization of control projects according to public health and environmental benefit rather than volume. The final RWSP adopted by the King County Council in 1999 included a revision to the CSO Control Plan that consisted of 21 control

projects to complete system control by 2030. It was included in an amendment to the CSO Control Plan—*Year 2000 CSO Control Plan Update* (2000 Plan Update)—with the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application. The 2000 Plan Update described King County's progress in CSO control, documented its compliance with CSO control requirements, and identified two large control projects—Denny Way/Lake Union and Henderson/Martin Luther King (MLK)/Norfolk CSO control projects—for completion in the next five-year NPDES permit cycle. The resulting Mercer/Elliott West and Henderson/MLK CSO control systems came online in spring 2005.

In the RWSP, the King County Council called for a review of the County's CSO control program ahead of the NPDES permit renewal application and update to the 2000 Plan that was expected to be due in 2005. Issuance of the NPDES permit took longer than expected, pushing back the due date for the next application to 2008. King County completed the review in 2006 as the basis for the CSO Control Plan Update (2008 Plan Update) which was then submitted as a part of the NPDES permit renewal application in 2008. The 2008 Plan Update described the County's wastewater system, the control status of its CSOs, and overall progress, indicated how the County meets the EPA's Nine Minimum Controls, and summarized the scientific studies that have shaped the control program over time. The 2008 Plan Update also described completed, in progress, and planned CSO control projects. No changes to the RWSP CSO Control Plan were recommended and King County committed to implementing the first four of the RWSP projects—Barton, Murray, South Magnolia, and North Beach—together known as the Puget Sound Beach Projects (described in Section 3 of this report).

1.2.2 2012 Plan Review and Long Term CSO Control Plan

The County's current CSO Control Plan was approved by the King County Council as the amended 2012 CSO Control Plan in September 2012. The 2012 CSO Control Plan was submitted to Ecology and EPA as the amended 2012 CSO Long Term Control Plan (LTCP) on November 20, 2012, ahead of the June 2013 application date for the NPDES permit renewal and as part of the CD negotiations. The adopted projects in the 2012 CSO LTCP emerged from a three-year comprehensive review of the CSO control program. During the review, King County evaluated new conditions, opportunities, science, regulations, and community input since the last major CSO plan update in 1999. Project alternatives were developed for all 14 uncontrolled CSOs to determine which were the most cost effective and cost efficient. The adopted projects reflected community priorities heard during the public review process, including:

- Completing most projects in the Lower Duwamish River area first to support ongoing regional efforts to clean up the river, with later projects to control CSOs in the Lake Washington Ship Canal.
- Conducting more detailed evaluation of the use of green stormwater infrastructure (GSI) on four projects to complement traditional CSO control techniques by diverting stormwater away from the combined sewer.
- Collaborating with the City of Seattle on projects when it is cost effective to do so.

The adopted plan contains nine projects to control 14 CSOs by the end of 2030 for a total cost of $711 million (2010 dollars). The schedule of projects is shown in Figure 2. Two projects are to construct CSO

high rate sedimentation wet weather treatment facilities in the Lower Duwamish and East Waterway area. Seven projects will control CSOs by building storage tanks or conveyance pipes. Four projects will be built in the Lake Washington Ship Canal/Montlake Cut area, and five in the Duwamish River/Elliott Bay area. The LTCP calls for King County and the City of Seattle to continue to collaborate on three of the seven storage tank projects and a possible West Ship Canal tunnel alternative until Seattle completes its decision on their LTCP in 2015. King County will conduct GSI early, ahead of traditional CSO control projects, in four basins to hopefully reduce the size of the gray infrastructure needed to control the CSO.

Detailed project information for the 2012 LTCP, including an interactive map, can be found at http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview.aspx

The King County Council also adopted a plan to complete a water quality assessment and monitoring study early in the plan schedule to confirm or to possibly adjust some of the future projects or schedules as part of an Integrated Plan proposal. The recommendation for this study emerged through conversations with stakeholders and the public asking that CSO control be evaluated more fully along with other programs that improve water quality in the region. The water quality assessment and monitoring study is discussed further in Section 1.2.4 Water Quality Assessment/Monitoring Study.

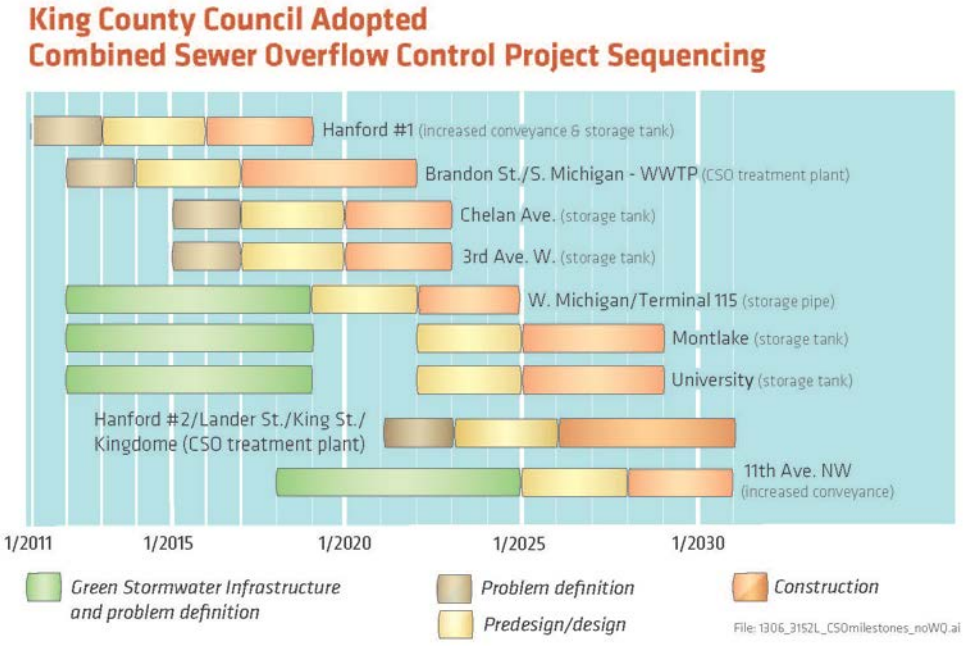

Figure 2. Adopted 2012 Project Schedule to Complete CSO Control Program by End of 2030

1.2.3 2018 CSO Long Term Control Plan Update

In 2015, King County will begin a comprehensive update of the CSO control program and the 2012 LTCP. The resulting 2018 CSO LTCP Update will be submitted to Ecology and EPA with the next West Point Treatment Plant NPDES permit renewal application, due mid-2018. WTD will be conducting two parallel

analyses of the 11 remaining uncontrolled CSO outfall locations where projects are not already being implemented, including a more detailed evaluation of CSO control selected in the 2012 LTCP and other options considered in past planning. The 2018 Update will include a comprehensive assessment of control measures for each uncontrolled outfall. The latter analysis is intended to be an extensive, innovative analysis and to include consideration of multi-basin and multiple control options. It will consider separation, GSI, and in-line or offline storage and treatment as well as collaborative or joint projects with the City of Seattle. The 2018 CSO LTCP will provide recommendations on any changes being considered to the 2012 CSO LTCP and include refined cost estimates, schedule and project priorities, and sizing assumptions. The updated project recommendations will reflect environmental, social, and financial goals to meet current needs, consider stakeholder interests, and the best approaches currently available to meet CD requirements.

1.2.4 Water Quality Assessment/Monitoring Study

King County has been conducting a Water Quality Assessment/Monitoring Study (WQA/MS) as directed by King County Ordinance 17413, Section 2. Work began in 2013 with the primary objective of generating information and recommendations for input to the 2018 CSO control plan update. The WQA/MS includes a comprehensive scientific and technical analysis of current water quality of the receiving waters where uncontrolled county CSOs discharge (Elliott Bay, Lake Union/Lake Washington Ship Canal, and the Duwamish River), projections of future conditions in these waters, and review of ongoing and planned activities to improve water quality. King County will use the information to identify opportunities to lower the costs of implementing the CSO control plan, establish baseline conditions for post-construction monitoring of CSO control projects, and decide whether to pursue an integrated CSO control plan allowed under the CD.

The assessment sets out to generate information that will help answer the following questions:

1. What are the existing and projected water quality impairments in receiving waters where King County CSOs discharge?
2. How do King County CSOs contribute to the identified impairments?
3. How do other sources contribute to the identified impairments?
4. What activities are planned through 2030 that could affect water quality in the receiving waters?
5. How can CSO control projects and other planned or potential corrective actions be most effective in addressing the impairments?
6. How do various alternative sequences of CSO control projects integrated with other corrective actions compare in terms of cost, schedule, and effectiveness in addressing impairments?
7. What other possible ways (e.g., coordinating projects with the City of Seattle and altering the design of planned CSO control projects) could make CSO control projects more effective and/or help reduce the costs to King County and the region of completing all CSO control projects by 2030?

Elements of the assessment and timeframes for their completion are shown in Table 1.

Table 1. Elements and Timeframes for the Water Quality Assessment and Monitoring Study

Element	Timeframe
Review and analyze existing scientific and technical data on impairments (defined as water quality-related concerns) in receiving waters where uncontrolled County CSOs discharge, the sources of impairments, and planned and potential corrective actions.	2013
Provide venues for stakeholders to be engaged throughout the process.	2013–2016
Conduct targeted data gathering and monitoring, as necessary, to fill identified gaps in scientific data on water quality in these receiving waters.	2014–2015
Analyze, synthesize, and summarize scientific and technical data collected in 2015 and reviewed during the assessment and produce a comprehensive synthesis report.	2015–2016

An external Scientific and Technical Review Team has been assembled to review methodology and results. A synthesis report will incorporate the results of the analyses, data gap studies, and additional assessments to evaluate how to maximize water quality benefits from CSO improvements. Depending on assessment findings, the King County Council may choose to direct the formation of an Executive's Advisory Panel of approximately ten regional leaders to develop independent recommendations to the King County Executive on CSO control project sequencing and other CSO water quality related activities.

More information on the assessment is available at:
http://www.kingcounty.gov/environment/wastewater/CSO/WQstudy.aspx.

1.3 Consent Decree

After King County Council approval of the 2012 CSO LTCP, King County submitted the LTCP to Ecology and EPA for approval. EPA and Ecology approved the County's LTCP as meeting federal requirements on March 7, 2013. EPA and Ecology, based on the approved version, finalized the negotiated CD between King County, EPA, and Ecology. The CD was formally filed in United States District Court on July 3, 2013. King County Council approved the CD in early 2013.

The CD commits King County to implement specified LTCP CSO capital projects within stipulated timelines, as well as complete several related plans (discussed below). King County has made it a high priority to meet these milestones, and to date, all projects have complied with the specified requirements of the CD.

Project summaries detailing 2014 progress, planned work in 2015, and their schedule of milestones can be found in Section 3.1 of this report.

1.3.1 Consent Decree Implementation

In addition to the specific LTCP CSO program implementation noted above and detailed in Section 3.1 below, the CD required several plans that are now completed or progressing well. These plans include:

- Supplemental Compliance Plans for Dexter Regulator CSO, Denny Regulator CSO, and Harbor Regulator CSO (submitted August 2013, with an amendment to the plan for Harbor submitted September 2013).
- Sewer System Operations Plan (SSOP), submitted September 2013. A letter approving the SSOP was received from Ecology on May 30, 2014. Some minor revisions have been requested and will be incorporated in the next update.
- Joint Plan with the City of Seattle (due March 1, 2016). Progress Reports were submitted by December 31, 2013 and December 31, 2014.

Summaries for these plans detailing 2014 progress, planned work in 2015, and their schedule of milestones can be found in Section 3.2 of this report.

1.4 Sediment Sampling and Analysis

King County prepared a sediment management plan (SMP) in 1999 for addressing contaminated sediment at County CSO locations. The County is updating that plan in 2015 and 2016. As a part of the update process, a predictive sediment contamination model for CSO discharges has been developed. Two supplemental rounds of sampling at CSO locations were used to calibrate and verify model performance. Sediment sampling results of the first round covering the Barton, Murray, North Beach, S. Magnolia, Chelan, 53rd, Brandon, Montlake, University, and 3rd Ave W CSO locations were provided to Ecology at the end of 2012. In 2012, a second set of sampling covered Belvoir and had additional sampling at University, Chelan, Murray, North Beach, and S. Magnolia. These results were provided to Ecology in April 2014. These two sampling events also collected baseline conditions at Barton, Murray, North Beach, and S. Magnolia for the post-construction monitoring requirement (see Section 6).

In 2011, King County delivered the report on the development and calibration of a near-field discharge model for contaminated sediments in the vicinity of CSOs. The work was partially conducted under Model Toxics Control Act (MTCA) grants G0800508, G0600259, and G0200213. The County requested that Ecology assess the utility of the model for sediment cleanup decisions for CSOs. King County's goal is for Ecology to formally approve the use of this modeling approach for evaluation of recovery and recontamination potential under WAC 172-204-560. Currently, work continues to refine the calibration of the model, using it to predict the potential for contamination at CSOs that have not been sampled and predict potential contamination at CSOs that have been sampled.

In 2014, King County delivered the final monitoring report for the Duwamish/Diagonal Sediment Remediation Project. The project is part of the Elliott Bay/Duwamish Restoration Program (EBDRP) and the result of a 1991 legal settlement reached by the City of Seattle and King County (then Metro) with the National Oceanic and Atmospheric Administration (NOAA).

The project site is within the south industrial section of Seattle, on the east side of the Duwamish River, upstream of Harbor Island, and immediately downstream of Kellogg Island in the lower portion of the Duwamish River. The original area extends about 750 feet along the shoreline upstream and downstream of the Duwamish/Diagonal Way outfalls and is 260 feet wide. An additional adjacent area

to the south extends about 500 feet along the shoreline upstream and downstream of the former Diagonal Avenue Treatment Plant outfall and the Diagonal Avenue South storm drain outfall. It is 160 feet wide and does not touch the shoreline. These areas were dredged to an average depth of 5 feet and 66,000 cubic yards of contaminated material was removed. The dredged material contained PCBs, but all dredged sediment was below the Toxic Substances Control Act (TSCA) PCB limit. The contaminated sediment was handled by Rabanco waste disposal and shipped by train to the Roosevelt Landfill in Klickitat County.

The project removed or isolated contaminated sediment near four outfall pipes on the Duwamish River in Seattle:

- Diagonal Way storm drain
- Hanford #1 and seven combined sewer overflows to the Diagonal Way storm drain
- The former Diagonal Avenue Treatment Plant outfall
- Diagonal Avenue South storm drain.

The long-term monitoring program met its objectives and demonstrated success of the remedial actions in reducing surface sediment contaminant concentrations and isolating remaining contamination under the cap. The long-term monitoring results indicate that PCBs and certain phthalates are the key chemicals to monitor for change at the site. The more recent monitoring events indicate average PCB concentrations in all monitoring areas except the perimeter appear to be stabilizing. Due to the consistency of monitoring data over time and the continued steady decline in the perimeter area monitoring data, King County believes the existing data are sufficient to evaluate the long-term status of recontamination potential from the four chemicals of concern and stability of the remedies. No further monitoring is planned or recommended.

1.5 Organization of this Report

Subsequent sections and appendices in this report present the following information:

- Section 2—report on implementation of EPAs Nine Minimum Controls.
- Section 3—status of CSO control projects in progress.
- Section 4—discussion of 2014 rainfall and CSO events.
- Section 5—summary of Consent Decree violations in 2014.
- Section 6—table showing the 20-year average frequency of untreated CSO events.
- Section 7—description of post-construction monitoring.
- Appendix A—detailed event-based tables for untreated CSOs in 2014.
- Appendix B—detailed event-based tables for treated CSOs in 2014.
- Appendices C through F—annual reports for the four satellite CSO treatments facilities—Alki, Carkeek, Mercer/Elliott West, and Henderson/MLK.

This report meets the requirements of the CD, WAC, and NPDES Permit that must be reported in annual reports. The following crosswalks indicate where information meeting the requirements can be found in this report.

Consent Decree Section	Content	Annual Report Location
VIII.43.a)	(i) the status of all Consent Decree compliance measures, including Currently Under Way and Early Action CSO Control Measures, the implementation of all CSO Control Measures in Appendix B, Post-Construction Monitoring Plan, SSOP, and Information Sharing/Coordination Program Plan Between County and the City of Seattle. (ii) any problems anticipated or encountered, along with the proposed or implemented solutions. (iii) any anticipated or ongoing operation and maintenance activities relating to all CSO Control Measures. (iv) remedial activities that will be performed in the upcoming year to comply with the requirements of this Consent Decree.	(i) 3.1 Project Summaries 3.3.1 Sewer System Operations Plan 3.3.2 Information Sharing/Coordination Program Plan Between County and the City of Seattle (called Joint Operations and Optimization Plan in the CD Appendix D) 7.0 Post-construction monitoring (ii) Included in sections above, 4.4 and App. C-F for CSO Treatment Facilities (iii) 2.1 Reducing CSOs Through Operations and Maintenance App. C-F for CSO Treatment Facilities (iv) All above
VIII.43.b)	A description of any non-compliance with the requirements of this Consent Decree and an explanation of the likely cause and duration of the violation and any remedial steps taken, or to be taken, to prevent or minimize such violation.	5.0 Summary of Consent Decree Violations in 2014 2.1 Reducing CSOs Through Operations and Maintenance App. C-F for CSO Treatment Facilities

WAC Section	Content	Annual Report Location
WAC 173-245-090(1)(a)	Details the past year's frequency and volume of combined sewage discharged from each CSO site, or group of CSO sites in close proximity. …The report shall indicate whether a CSO site or group of sites has increased over the baseline annual condition.	4.0 Summary of Rainfall and CSO Events 6.0 Twenty-Year Moving Average of Event Frequencies Appendix A Untreated CSO Events Appendix B Treated CSO Events App. C-F for CSO Treatment Facilities
WAC 173-245-090(1)(b)	Explains the previous year's CSO reduction accomplishments.	3.1 Project Summaries
WAC 173-245-090(1)(c)	Lists the projects planned for the next year.	3.1 Project Summaries

NPDES Permit WA0029181	Content	Annual Report Location
S18.B.2.	In the Annual CSO Reports, the Permittee must include a summary of the number of untreated discharge events per outfall on a 20-year moving average, calculated once annually. The Permittee must determine which of the permitted CSO outfalls can be categorized as meeting the "greatest reasonable reduction" which means control of each CSO such that an average of one untreated discharge may occur per year. The Permittee must determine whether a CSO outfall meets this regulatory requirement based on historical long-term discharge data (total of 20 years – past and present data), modeling, or other reasonable methods as approved by Ecology. A listing of CSO outfalls which have been identified by the Permittee as meeting this regulatory requirement must be included in the CSO Annual Reports. At the same time of the annual CSO Report submission, the Permittee must also submit an electronic template file that includes event-based reporting for all CSO discharges for the reporting period. Ecology will provide the electronic template file to the Permittee.	6.0 Twenty-year Moving Average of Event Frequencies Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B
S18.H.	Compliance with the Nine Minimum Controls must be documented in the annual CSO Annual Report as required in S18.B.2.	2.0 Programs to Meet EPA's Nine Minimum controls
S18.K.1.	The Permittee must report the average number of discharge events per controlled outfall per year based on a 20-year moving average to be reported in the annual report per S18.B.2. Compliance with the performance standard is determined annually.	6.0 Twenty-Year Moving Average of Event Frequencies
S18.K.2.	The Permittee must report the number of overflow events per year during this permit term from the below-listed CSO outfalls in the Annual CSO Report and the CSO Reduction Plan Amendment required in Sections S18.B.2 and S18.C, respectively.	6.0 Twenty-Year Moving Average of Event Frequencies Appendix A Untreated CSO Events Appendix B Treated CSO Events App. C-F for CSO Treatment Facilities

2.0 Programs to Meet EPA's Nine Minimum Controls

The Nine Minimum Controls are actions that can be taken to minimize CSO impacts while long-term capital projects are under way. King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are a part of EPA's codified CSO Control Policy and included in the NPDES permit. The following sections describe King County's programs and activities in regard to each of the Nine Minimum Controls, with emphasis on activities undertaken in 2014.

2.1 Control 1—Reducing CSOs through Operation and Maintenance

Implement proper operation and maintenance programs for the sewer system and all CSO outfalls to reduce the magnitude, frequency, and duration of CSOs. The program must consider regular sewer inspections; sewer, catch basin, and regulator cleaning; equipment and sewer collection system repair or replacement, where necessary; and disconnection of illegal connections.

Proper facility operation is managed by West Point Treatment Plant and South Treatment Plant staff using King County's Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides monitoring and control capabilities for the treatment plant collection systems. See Control 2 for information on King County's transition to a new SCADA system. Asset management programs, implemented by West Point Treatment Plant, South Treatment Plant, and conveyance inspection staff, ensure regular maintenance of CSO outfalls, regulator stations, and pump stations. Conveyance inspection staff inspects sewers on a specified schedule and perform corrective actions when deficiencies are found. Maintenance schedules and records of visits are available for inspection on request.

Under the Asset Management Program, updated in 2010, King County employs asset management tools, including a standardized inventory system and condition rating systems, and is developing long-range asset replacement and renewal forecasts, including action plans, to avoid failure of critical assets.

A review performed by King County several years ago indicated that installing permanent backup generators in pump stations that lack reliable dual power feeds could help to prevent overflows. The installation process is nearly complete. The last two generators will be installed at the Barton and Murray pump stations by December 31, 2016, as part of a pump station upgrade project (Barton) and CSO control projects (Murray). Until then, a portable generator is available.

Major Improvement Projects Under Way at West Point Treatment Plant during 2014

The following improvements were under way during 2014 to improve the solids process, which can limit the amount of flow that can be treated.

Screenings Building and Upgrades

In 2014, the existing six 5/8-inch screens were replaced with finer screens: four 3/8-inch and two 1/4-inch screens. New screenings handling facilities were constructed to process the increased volume of the screened material and new washer/compactors were installed to produce cleaner and drier

screenings. This new washing/compacting process will result in fewer truck trips leaving the plant and reduced odors.

Dewatering Equipment Replacement

Dewatering is critical to Loop (biosolids) production and reduction of hauling costs. Centrifuge replacement was selected over a number of dewatering options. The project includes demolition and replacement of existing centrifuge platforms and installation of four high energy-efficiency Centrisys centrifuges. This project is ongoing.

Digester Floating Cover Repairs

The repairs include corrections to leaking sumps and truss chords, Coal tar patching and installation of anti-rotation casters for Digester 2. This project was completed in 2014.

Major Improvement Projects Completed or Under Way at CSO Treatment Facilities during 2014

The following operation and maintenance (O&M) activities have been implemented at the CSO treatment plants as part of the effort to improve operations. These activities have been described to EPA and Ecology in regular briefings provided by King County Operations and NPDES staff. More detail on CSO treatment facility O&M activities is available in the facility annual reports in the Appendices.

Alki CSO Treatment Plant

Completed Activities

- Completed Dechlorination System Improvement Project in July 2014, which increased the sodium bisulfite (SBS) treatment storage volume and added control modes for different operating circumstances.
- Completed improvements to the influent sampling system by relocating the influent sample intake and sampling equipment to the division channel.
- Installed new on-line amperometric chlorine residual analyzers for the inflow (intermediate chlorine residual), final effluent, and pre-dechlorination chlorine residual monitoring and reporting.

Current and Future Activities

- Continue to evaluate and make any necessary adjustments to the dechlorination system.
- Continue with the project for new Variable Frequency Drives for the 63rd Avenue SW pumps. The design will be completed in spring 2015, with construction to begin in September 2015 and completed in 2016.
- Begin the process to evaluate feed pump capacity size and make recommendations on the replacement of the current oversized hypochlorite feed pumps.

Carkeek CSO Treatment Plant

Completed Activities

- Modified the SBS feed system to include valves and fittings to be able to recirculate SBS back to the storage tank and flush the feed line.
- Provided annual CSO refresher training for the off-site operations staff in September 2014.
- Completed project to improve flow measurements, which included new flow meters and a modified final effluent weir.
- Purchased and installed new hypochlorite feed pumps.

Current and Future Activities

- None planned.

Henderson/MLK CSO Treatment and Storage Facilities

Completed Activities

- A carbon filter was installed for dechlorination of the City's water. This addition allows the chlorine analyzer to remain calibrated at lower discharge limits.

Current and Future Activities

- No major projects are currently in progress. Proposed upgrades are included in Appendix F.

Elliott West/Mercer CSO Treatment and Storage Facilities

Completed Activities

- Completed the repair and upgrade of City of Seattle water service to the Denny Station.
- Replaced both dewatering pumps with new pumps.
- Replaced one of the two SBS flash mixers.
- Implemented additional procedures to the post-discharge event routines, including equipment testing, cleaning, and de-ragging within the dechlorination and final effluent vaults/structures.

Current and Future Activities

- Began project to relocate and improve sample delivery and to relocate the process instrumentation and monitoring equipment at Denny station.
- Continuing to investigate and correct the cause(s) of the instantaneous minimum pH exceedance.
- Evaluating the recently completed Final Effluent Monitoring Improvement Project.
- Implement a manual CSO pumping strategy.
- Implement copper and dissolved oxygen monitoring.

- Implement additional laboratory solids analyses on all sampled flows as part of the monitoring of the automated Mercer Tunnel flushing program.

2.2 Control 2—Storing CSOs in Collection System

Implement procedures that will maximize use of the collection system for wastewater storage that can be accommodated by the storage capacity of the collection system in order to reduce the magnitude, frequency, and duration of CSOs.

The West conveyance system is essentially a deep inline tunnel system that conveys and stores a wide range of flows. Figure 3 identifies the sizing of the largest in-line tunnels. As described in the 2014 SSOP, maximizing storage in the conveyance system works in concert with maximizing conveyance to the West Point Treatment Plant to minimize CSOs and obtain high quality treatment for service area flows. The 2014 SSOP describes how the system has been built to operate based on levels in the interceptors and trunks, and gravity flow as much as possible, with little operator intervention.

When levels reach pre-determined set points, PLC automatically adjust gates and pumps to manage the flows. These set points have been determined over the years by experience, hydraulic analysis, and modeling to balance maximizing conveyance to the plant while maximizing storage in the pipelines and off-line storage facilities, and minimizing overflows and backups. Critical alarms and process data are communicated to the plant operators using monitoring systems that report data in independent communication pathways from the control system. Operators at West Point Treatment Plant's Main Control will remotely take control of certain facilities – primarily Interbay Pump Station to force storage in the Mercer Tunnel, and the West Seattle Pump Station to force storage in the West Seattle Tunnel – to manage flows to and through the West Point Treatment Plant. The intent is to avoid surges and oscillations in the plant in order to protect the biological system and avoid plant shut-down, optimize conveyance of flows to the plant for treatment, and maximize the use of system storage capacity.

Senior operators assess a range of system factors in making decisions to begin manual control. Which factors are most important depends on the direction storms come from, how fast flows are changing, and antecedent conditions. Decisions require extensive senior operator experience, a sense for antecedent conditions, and the ability to anticipate changing flows.

In 2003, King County embarked on a division-wide effort to improve its operations by developing instrumentation and control standards that would be applied to all of its existing facilities. After developing the standards, Ovation™ by Emerson Process Management was selected as the control system. The control system was designed to enable regional monitoring and control of all facilities feeding King County's treatment plants. The South Treatment Plant upgrade is complete and work continues at the West Point Treatment Plant. It is anticipated that the Ovation control system upgrades will be completed system-wide by the end of 2016.

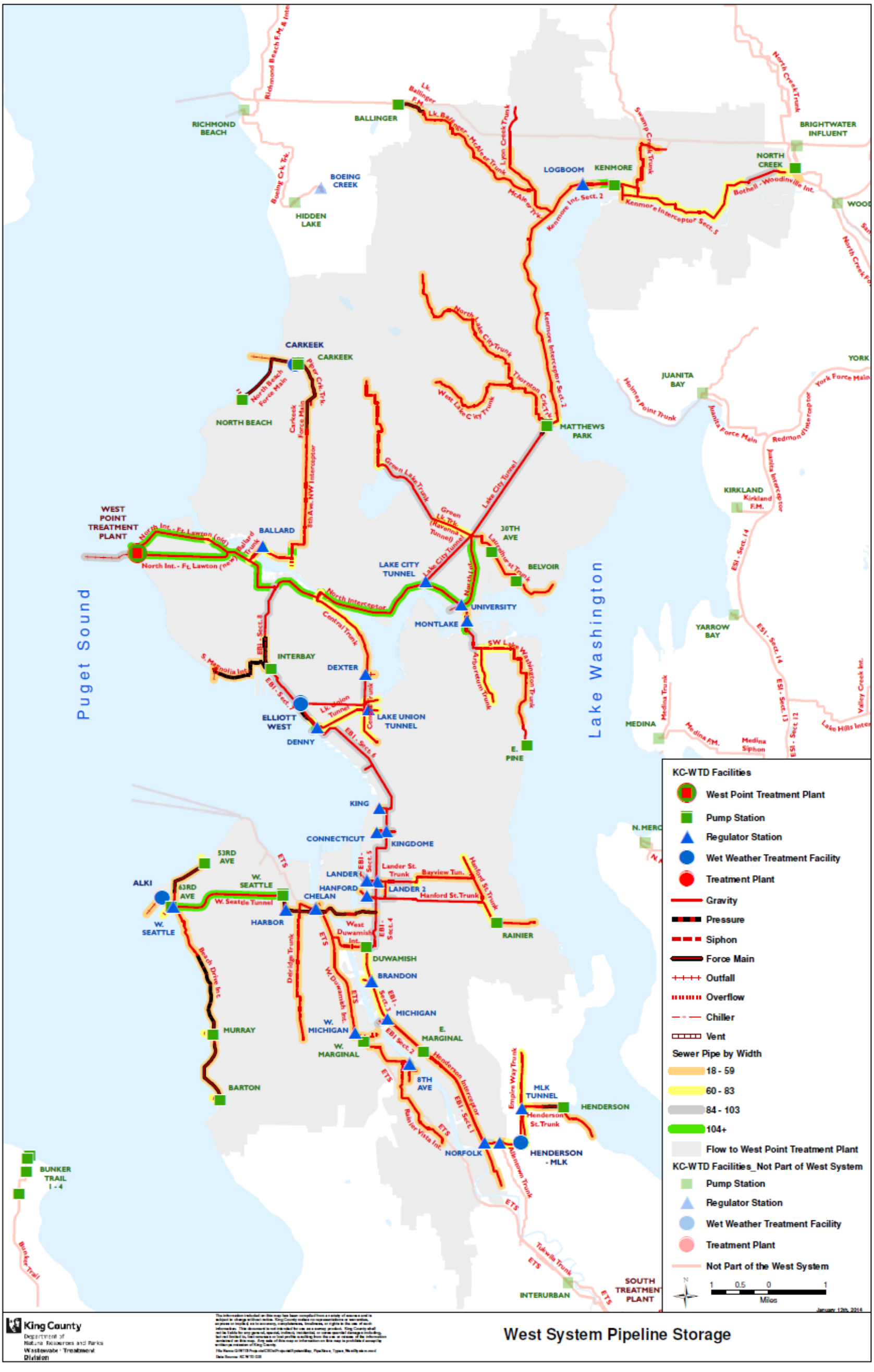

Figure 3. West System Pipeline Storage

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In 2005, King County installed the OSI PI™ process data historian for long-term trending of all key King County process, operational, and monitoring data (treatment plants, conveyance facilities, CSO control facilities, and offsite pump stations). King County periodically modifies the collection system control strategies in response to data trends, to take into account advances in SCADA and computer modeling, to incorporate more recent field data, and to reflect modifications to the wastewater system.

In addition, the amended 2012 King County LTCP includes seven collection system upgrade and storage projects for CSO control that will increase collection system storage.

2.3 Control 3—Optimizing Pretreatment Program

Review and modify, as appropriate, existing pretreatment program to minimize CSO impacts from discharges due to nondomestic users.

King County's Industrial Waste Program (IWP) issues approvals that set limits on the chemical contents of industrial discharges. The program includes monitoring and permit enforcement, education, and technical assistance to businesses on appropriate waste pretreatment and disposal techniques. Local discharge limits are reviewed on a regular basis according to Ecology requirements. The County submits an annual pretreatment report to Ecology detailing permitting, monitoring and inspections, and enforcement actions taken during the year as well as an evaluation of influent, effluent, and biosolids focusing on loading and removal rates. King County also administers and helps fund the Local Hazardous Waste Management Program.

Influent and effluent quality at the West Point Treatment Plant is assessed for trends that would suggest concurrent changes in CSO discharges. In addition, biosolids quality data from the West Point Treatment Plant are tracked as an indicator of changed loading to the system that could influence CSO quality. The only trends seen are the slow decrease or stability in pollutant concentrations.

The County completed the Source Tracking Characterization study to more fully characterize industrial discharges as required in the previous NPDES permit. This wastewater characterization study of selected industrial users did not identify any new sources of chemical inputs that have the potential to impact the King County sanitary sewer system. In addition, the study confirmed the appropriateness of the current mechanisms in effect to regulate the discharges of industrial wastewater to the sanitary sewer including:

- the numerical local discharge limits
- the federal categorical discharge limits
- the authority from King County Code (Title 28)
- the local discharge limits public rule to establish discharge limits for organic chemicals on a case-by-case basis.

The results of the King County Source Tracking Characterization were submitted with the application for the renewal of the West Point Treatment Plant NPDES permit in 2013.

King County is currently working with Ecology to develop a Source Control Implementation Plan for the Lower Duwamish. A draft is still under review by Ecology.

2.4 Control 4—Maximizing Flow to Treatment Plant

Operate the POTW [publicly owned treatment works] at maximum treatable flow during all wet weather flow conditions to reduce the magnitude, frequency, and duration of CSOs. The Permittee must deliver all flows to the treatment plant within the constraints of the treatment capacity of the POTW.

The 2014 SSOP describes how maximizing storage in the conveyance system works in concert with maximizing conveyance to the treatment plant to minimize CSOs and obtain high quality treatment for service area flows. As described in Control 2 and shown in Figure 3, the West system is essentially a deep in-line tunnel system that can convey a wide range of flows to the West Point Treatment Plant. SCADA is used to maximize flow to the secondary treatment plants, while protecting the biological treatment system, via operation of regulators and pump stations. The parallel Fort Lawton Tunnel was built in 1992 to convey up to 440 million gallons per day (MGD) to the West Point Treatment Plant. West Point Treatment Plant provides secondary treatment for all base flows (defined by Ecology as 2.25 times the average wet-weather flow) and CSO/primary treatment for flows between 300 MGD and the peak hydraulic capacity of 440 MGD. CSO/primary treated flows are mixed with secondary effluent for disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small reduction—80 percent instead of 85 percent removal during the wet season months of November through April—in total suspended solids (TSS) percent removal requirements.

Up to 24 MGD of combined flows are conveyed to South Treatment Plant from southeast Seattle to receive full secondary treatment. This conveyance minimizes CSOs to the Duwamish River along the Elliott Bay Interceptor.

Where captured CSO cannot be conveyed to secondary plants due to conveyance system limitations flows are conveyed to CSO treatment facilities. King County currently operates four CSO treatment facilities at Alki, Carkeek, Elliott West, and Henderson/MLK. The amended 2012 King County LTCP includes two additional facilities to maximize treatment (Georgetown Wet Weather Treatment Station (formerly Brandon and Michigan), and Hanford/Lander/King/Kingdome).

Treatment process stability is monitored and optimized to manage flows based on information from automatic sensors and an array of analytical tests. Process control laboratories at each plant conduct the testing and analysis and then recommend adjustments to the processes if necessary to ensure that quality treatment is provided.

2.5 Control 5—Preventing Dry-Weather Overflows

Dry weather overflows from CSO outfalls are prohibited. The Permittee must report each dry weather overflow to the permitting authority as soon as it becomes aware of the overflow. When it detects a dry weather overflow, the Permittee must begin corrective action immediately and inspect the dry weather overflow each subsequent day until it has eliminated the overflow.

The County provides enough capacity in the combined sewer system to transfer 2.25 times the average wet-weather flow to secondary treatment, as negotiated with Ecology. As a result, overflows during the dry season are not the result of a lack of capacity. During dry weather, the County only experiences overflows in the combined system when problems such as power outages, mechanical failures, or human error occur. Similarly, during wet weather, CSOs occurring as a result of precipitation may be exacerbated by power outages, mechanical failures, or human error. While these events are rare and are immediately corrected and reported to Ecology, King County's ongoing Asset Management Program reduces the likelihood of these kinds of failures.

To minimize the risk of a dry-weather overflow (DWO) due to power loss at a pump station, a capital program was initiated to install new backup generators and replace old generators that had reached the end of their useful life. This program will be completed with the installations at Murray and Barton pump stations by December 31, 2016. By installing generators and automatic power transfer systems at pump stations throughout the system, the program greatly reduces the risk of overflows associated with a loss of power.

To minimize the risk of mechanical failure, the King County Asset Management Program includes an assessment to determine the criticality of pump station equipment. This assessment identifies assets essential to pumping sewage, and inspection and maintenance routines have been developed to increase service time and reduce failures for these critical assets. These efforts contribute to reducing overflows by decreasing the probability of mechanical failures.

Operation and maintenance programs, as described for Control 1, focus on DWOs and exacerbated CSOs. The conveyance system is monitored through SCADA and direct inspection, and corrective action is taken immediately if a problem occurs. Equipment problems are immediately reviewed and repair or replacement is undertaken in a timely manner.

2.6 Control 6—Controlling Solids and Floatables

Implement measures to control solid and floatable materials in CSOs.

The majority of floatables in the King County system are captured in the large volume of wastewater transferred to the treatment plants before overflows occur.

The County routinely engages in the following practices to control floatables:

- Capturing the "first flush" (maximizing flow to treatment plants) so that most solids and floatables that do enter the sewer are conveyed to the plant for removal and disposal before pipelines reach overflow conditions.
- Constructing facilities with gates and weirs that retain and minimize the release of solid and floatable materials. Gates are set to maximize flow containment. Baffles are used in front of weirs to help hold back all but the smallest items in the flow that passes over them.

- Coordinating with the City of Seattle on measures to reduce the washing of street solids and trash into sewers via stormwater and to promote proper disposal of trash so that it is not flushed down toilets. The City of Seattle's catch basin maintenance program limits the introduction of floatable materials to sewers.
- Educating the public on keeping trash and grease out of the sewers (http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo.aspx)
- Encouraging less water use to reduce unnecessary flows in the sewer that contribute to overflows: http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo/UseLessWater.aspx.
- Monitoring the development of new floatables control technologies for future CSO control projects.
- Educating the public on flushable items. In recent years, WTD operations employees have noticed an increasing number of mechanical problems, equipment breakdowns and other operational impacts that seem to be closely related to the growing popularity of flushable cleaning wipes and pads. King County developed its "Flushing Awesome" information campaign in 2014 to educate the public about the problems caused by wipes and trash in the sewer system. The goal was to create awareness about how simple changes at home, such as using a trash can instead of a toilet, can protect Puget Sound and help keep our sewers working right. The campaign included radio and television ads in English, Spanish and Mandarin Chinese that ran in the summer of 2014, as well as bus advertising. More information is available at http://www.flushingawesome.com.

Observations of the quantity of floatables are noted in logs at each facility and are available for inspection on request. These observations and a three-year floatables study, ordered by EPA in July 2009, to observe for floatables in water bodies near nine CSOs within four hours of an overflow confirmed that additional floatables and solids controls are not needed at this time. During the study, overflow observations were compared to photos of each area during summer non-overflow periods. Before and after photos showed no accumulation of sewage-related solids or floatables around the discharge points. The final floatables report was submitted to Ecology and EPA concurrent with the 2011 CSO Annual Report.

2.7 Control 7—Preventing Pollution

Implement a pollution prevention program focused on reducing the impact of CSOs on receiving waters.

King County IWP is a major participant in the Local Hazardous Waste Management Program. Both programs serve to reduce discharge to sewers of chemicals and other substances that adversely impact the environment and the wastewater treatment process.

IWP limits the discharge of fats, oil, and grease (FOG) from a petroleum or mineral origin (nonpolar FOG) to 100 milligrams per liter. Industries must use oil/water separators to pretreat oily wastewater to prevent harm to the biological phase of wastewater treatment and must submit plans for the separators

to the local sewer utility or to IWP for review and approval before installing the separators. FOG from an animal or a vegetable origin (polar FOG) can block sewer lines. Although polar FOG has no numerical limit, dischargers are required to minimize free-floating polar FOG and may be required to complete a FOG control plan for IWP's review and approval.

King County also prohibits discharge to the sewer of materials such as ashes, sand, grass, and gravel. Industrial wastewater must contain less than 7 milliliters per liter of solids capable of settling. Food waste, including food-grinder waste, must be capable of passing through a 0.25-inch sieve. Discharge rates and maximum volumes are also set for construction dewatering projects with strict restrictions during the wet season.

Educational materials on controlling trash disposal to sewers are a part of the larger public information program as described in Control 6.

In partnership with the City of Seattle, King County has administered the RainWise program since 2010. This program provides rebates to homeowners living in specific combined sewer areas for installing rain gardens and cisterns on their own property. RainWise helps to slow, detain, or retain stormwater, which reduces both the volume and timing of flows as well as sources of pollution into the combined system.

King County manages a small grant program to help residents and small businesses implement small-scale projects to improve air and water quality and support the success of King County's CSO projects by controlling new and ongoing sources of pollution that could harm the environment or re-contaminate cleaned up areas in the waterway. The grants also help promote partnerships around source control, develop local expertise in water quality protection, and enhance small-scale environmental and economic opportunities in the community. The grants help King County residents protect their long-term investment in CSO projects.

As part of the King County grant program, the Puget Sound Clean Air Agency (PSCAA) settlement agreement (Notice and Order of Civil Penalty No. 12-020 CP Section III.C.) stipulated awarding $411,300 in grants over four years for air or water quality improvement projects, salmon habitat protection and restoration projects, or environmental education and community outreach efforts within the Green River/Duwamish River basin. The grant award funding is divided over the four year period; the amount is $104,670 for each year. For 2014, the projects and recipients are:

- *RainWise Access Grants for the Duwamish, Stewardship Partners ($35,000).* This project addresses the issue of accessibility within the RainWise program by piloting an "access grant" program for low-income homeowners in South Park and Highland Park. These access grants will be provided to a minimum of 50 low-income homeowners who would not otherwise be able to participate in the RainWise program due to out-of-pocket expense barriers.
- *Finding Our Way to the Future: Initiating a Duwamish Valley Climate Resilience and Adaptation Plan, Sustainable Seattle, ($30,000).* This project will build capacity for community leaders to initiate climate resiliency and adaptation planning by providing outreach material and expert-led discussions with community leaders. The project builds the capacity of neighborhood leadership

to better understand climate impacts in the Duwamish Valley and supports the Executive's Climate Change Initiative.

- *Depave the Duwamish, Sustainable Seattle ($22,825).* This project will emphasize hands-on learning to educate residents about polluted runoff from impervious surfaces, climate change, the heat island effect, and air quality issues in the Duwamish Valley. By identifying and depaving impervious surfaces on private properties and replacing them with green spaces, this project will engage residents while documenting the story for future use. Additional emphasis will also be placed on building collaboration between stakeholders.
- *Westcrest Dog Park Runoff Mitigation, Stewards of Westcrest Dog Park, ($7,500).* This dedicated volunteer organization will leverage community resources to develop and implement a stormwater mitigation strategy that will prevent polluted runoff from flowing downstream to the Duwamish River. The project will conduct volunteer hands-on restoration and invasive weed removal. In addition, rain gardens will be designed to filter runoff where a polluted pond currently forms. The project will also engage the community on stormwater runoff and how the RainWise rebate program addresses polluted runoff. The grant is contingent on approval from Seattle Parks.
- *South Park Planters, Christine Makela and Seattle Tilth's Just Garden ($7,500).* This project will "green" the South Park neighborhood by constructing raised bed vegetable gardens in public spaces and the yards of homeowners and renters. The project will improve air quality and bring organic food to this neighborhood that lacks access to fresh, healthy food. The project will also acquaint the neighborhood with other options for "greening," such as free street trees and the RainWise rebate program.

In 2012, King County funded a three-year Source Control Inspector position within the Department of Ecology to conduct stormwater inspections in combined basins. In 2015, King County will evaluate the findings from the inspections to assess trends that would suggest changes in current County procedures that could influence CSO quality. In addition, in June 2014, King County submitted a draft Source Control Implementation Plan for the Lower Duwamish to Ecology that includes identifying and tracing sources in the combined system that discharges to the Lower Duwamish. The Brandon basin was targeted in 2014.

2.8 Control 8—Notifying the Public

Implement a public notification process to inform the citizens of when and where CSOs occur. The process must include (a) a mechanism to alert persons of the occurrence of CSOs and (b) a system to determine the nature and duration of conditions that are potentially harmful for users of receiving waters due to CSOs.

King County operates a CSO Notification and Posting Program as a joint project with the City of Seattle and Public Health–Seattle & King County. This program includes the posting of signs at publicly accessible CSO locations, an information phone line, websites, a brochure, and other public outreach activities.

A website providing real-time notification of recent and current CSO discharges went live in December 2007 (http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx). In April 2011, King

County completed the process to incorporate City of Seattle real-time overflow information on this website. The website presents overflow status for the majority of City and County CSOs with links to and from each agency's independent website. The community has access to consolidated information to assist in making choices about use of local waters.

In 2014, the CSO Control Program and the CSO Status Web pages had 22,447 page views (representing 16,183 unique page views, with 55% "bouncing" to deeper page levels). This is approximately double the views in 2013.

In 2014, King County continued ongoing community involvement efforts at the individual project and the program-wide levels to help keep the public informed of the CSO Control Plan. Extensive outreach continues to be conducted to answer questions and build public support for facility design and implementation of the four Puget Sound Beach Projects. Community input generated from these efforts influenced project design decisions including facility location, landscaping, and architecture for all four projects. Community support in the Barton Basin for the RainWise program was factored into the County's decision to incorporate the program into its Control Plan. Recommendations from the Murray CSO Control Facility Design Advisory Group were integrated into the facility's architectural features and art. The two new projects to control Hanford 1 (Rainier Valley Wet Weather Facility) and Brandon and Michigan (Georgetown Wet Weather Treatment Station) implemented their outreach and involvement programs. King County uses resources and skills throughout the division to support community based education partnerships, providing resources that will in turn be further disseminated throughout the region.

2.9 Control 9—Monitoring CSO Outfalls

Monitor CSO outfalls to characterize CSO impacts and the efficacy of CSO controls. This must include collection of data that will be used to document the existing baseline conditions, evaluate the efficacy of the technology-based controls, and determine the baseline conditions upon which to base the long-term control plan. This data must include:

- ***a. Characteristics of the combined sewer system, including the population served by the combined portion of the system and locations of all CSO outfalls in the combined sewer system.***
- ***b. Total number of CSO events and the frequency and duration of CSOs for a representative number of events.***
- ***c. Locations and designated uses of receiving water bodies.***
- ***d. Water quality data for receiving water bodies.***
- ***e. Water quality impacts directly related to CSO (for example, beach closing, floatables, wash-up episodes, fish kills).***

In 1986, Metro began a sampling program to characterize each CSO and identify high priority sites for early control. The program included collecting overflow quality data for five CSO sites per year and collecting sediment samples at each site. In the 1990s, sampling was expanded to assess compliance with state Sediment Management Standards. The County's extensive monitoring for its 1999 CSO Water Quality Assessment of the Duwamish River and Elliott Bay found that the majority of risks to people,

wildlife, and aquatic life would not be reduced by removal of CSOs because most risk-related chemicals come from sources other than CSOs.

Under the NPDES permit for the West Point Treatment Plant, King County developed a comprehensive sediment quality summary report for all CSO discharge locations (submitted December 2009). It can be found at: http://www.kingcounty.gov/environment/wastewater/CSO/Library/SedQualSum.aspx

The King County Post-Construction Monitoring Plan (PCMP) was submitted to Ecology in July 2010 and was approved on September 28, 2012. It can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/ProgramReview/2012/AppH_CSO_PostConstructionMonitoringPlan,Sept2012.pdf

The County submitted ambient monitoring data near CSO plant outfalls with the NPDES permit renewal application in June 2013, and will implement additional sediment sampling if required by Ecology. Data from additional 2013 sampling was submitted to Ecology in April 2014.

3.0 Currently Under Way and Early Action CSO Control Measures

This section describes the progress made on implementing current CSO control projects and projects that affect CSO control. It includes project specific summaries of progress made in 2014 and planned for 2015, and where each project is in relation to its schedule of milestones.

The CD requires the County to report on projects under way and early action CSO control measures. A summary of the CD milestone statuses through 2014 are below:

Project Name	CD Milestone and Required Date	Actual Date
Barton Pump Station Upgrade	Start of construction	June 2012
Barton	Start of construction by December 2013	October 2013
Georgetown Wet Weather Treatment	No applicable milestone reached to date	N/A
Murray	Start of construction by December 2013	October 2013
North Beach	Start of construction by December 2013	December 2013
Rainer Valley Wet Weather Storage	Submitted Facility Plan by December 2014	February 2014
South Magnolia	Start of construction by December 2013	December 2013
Dexter Supplemental	Submitted to Ecology & EPA	September 2013
Denny Supplemental	Submitted to Ecology & EPA	September 2013
Harbor Supplemental	Submitted to Ecology & EPA	September 2013

The CSO component of the Ballard Siphon Project achieved the performance standards in 2014. In accordance with the Post-Construction Monitoring Plan, ambient water quality monitoring will continue in the Lake Washington Ship Canal and sediment characterization will occur after an area-wide clean up in the Lake Washington Ship Canal. In addition, the Ballard CSO meets Water Quality Standards under the one-event per year exemption (WAC 173-201A-400).

3.1 Project Summaries

A summary project status page for each active project follows.

CD/CSO Report Project Status – Barton Pump Station Upgrade

CSO(s): DSN 057 Barton

Project Description: Increase capacity of the Barton Pump Station through replacement of existing pumps with larger units providing 33 MGD capacity. Add a standby power generator, an upgraded control system, and new odor control system. This project is not a CD project, but is an asset management project that provides additional CSO control. The Barton Combined Sewer Overflow Control Project builds on this to achieve final CSO control. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonSt.aspx

Milestones	Milestone Date	2012	2013	2014	2015
Start of Construction	6/04/2012				
Construction Completion	6/30/2015				

2014 Accomplishments

- Completed pump station concrete placement.
- Installed underground fuel storage tanks, pumps, and electrical equipment.
- Began station start up and commissioning.

2014 Challenges and Corrections:

- Electrical systems installation took longer than anticipated and so subcontractor added more electricians to meet the schedule.

2015 Activities in progress or expected:

- Site restoration and art installation will be complete by June 2015
- Contract closeout will be complete by third quarter of 2015

CD/CSO Report Project Status –
Barton Combined Sewer Overflow Control (Barton)

CSO(s): DSN 057 Barton

Project Description: Construct green stormwater infrastructure (biorentention swales and associated drainage structures) and underground injection control wells for CSO control. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonCSO-GSI.aspx

Milestones	CD Milestone Date	2010	2011	2012	2013	2014	2015	2016	2017
Submission of Facilities Plan	N/A	Draft Submitted 12/31/2010 Final Submitted 9/2011							
Submission of Final Plans & Specifications	12/31/2012			Draft Submitted 12/31/2012 Final Submitted 06/13/2013					
Start of Construction	12/31/2013				10/21/2013				
Construction Completion	12/31/2016			10 Streets: 11/30/2014					
Achievement of Performance Standard	12/31/2017								

2014 Accomplishments:

- Completed construction of bioretention swales and associated drainage structures on 10 of the 15 streets (2 more streets than planned).
- Completed construction of underground injection control wells on all fifteen streets.
- Issued substantial completion for the constructed streets.
- Adjusted the sewer and water services and installed new water service meters on the remaining five streets.
- Initiated monitoring and maintenance on completed streets.

2014 Challenges and Corrections:

- Implementing the Rule 171 tax rate after contract was awarded. By working with project control and finance staff, the billing was corrected and the County saved over $163,000 in taxes.

2015 Activities in Progress or Expected:

- Complete construction on the remaining five streets.

CD/CSO Report Project Status – Georgetown Wet Weather Treatment Station

CSO(s): DSN 041 Brandon and DSN 039 S. Michigan
Project Description: Site, design, and construct a wet weather treatment station, associated conveyance, and marine outfall. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BrandonMichiganCSO.aspx

Milestones	CD Milestone Date	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Submission of Facilities Plan	12/31/2015											
Completion of Bidding	12/31/2017											
Construction Completion	12/31/2022											
Achievement of Performance Standard	12/31/2024											

2014 Accomplishments:

- Selected treatment technology and began procurement processes for ballasted sedimentation and ultra-violet disinfection.
- Initiated site selection process and narrowed to 19 sites, then to 5 sites coupled with conveyance routes ("systems"), and then finally to two systems proposed by July 2014.
- Completed an audit of the project July 2014.
- Conducted an independent review of the project October 2014.
- Formed a Project Review Board to provide oversight of the project. The board consists of senior management as well as two outside consultants.
- Adopted a cost control plan and amended the design contract to incorporate this plan.
- Began geotechnical field investigations and survey work, which will continue through early 2015.

2014 Challenges and Corrections:

- Due to the results of an internal audit and preliminary cost estimates, WTD initiated an independent review of the project to confirm that CSO treatment was still the recommended option for controlling CSOs in Georgetown. The internal independent review verified the recommended option.

2015 Activities in Progress or Expected:

- Complete two percent design of the two proposed systems.
- Negotiations underway for a planned phased amendment to the design contract. This amendment will take the project to 60 percent design.

- Initiated an Expert Review Panel which will review opportunities for optimization of the project
- Conduct several cost control analyses and workshops.
- Continue outfall research. (Meetings with Ecology have been completed.)
- Select final system alternative with specific treatment plant site and outfall structure location.
- Prepare and submit Facility Plan to Ecology prior to CD deadline.
- Continue community outreach meetings and activities. Formation of a community design advisory group and two meetings have been completed.

CD/CSO Report Project Status –
Murray Combined Sewer Overflow Control (Murray)

CSO(s): DSN 056 Murray

Project Description: Construct CSO Storage Tank. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/MurrayCSOStorage.aspx

Milestones	CD Milestone Date	2010	2011	2012	2013	2014	2015	2016	2017
Submission of Facilities Plan	N/A	Draft Submitted 12/31/2010 Final Submitted 9/2011							
Submission of Final Plans & Specifications	12/31/2012								
Start of Construction	12/31/2013				10/16/2013				
Construction Completion	12/31/2016								
Achievement of Performance Standard	12/31/2017								

2014 Accomplishments:

- Installed soil nail retaining wall prior to secant shoring wall installation.
- Installed secant shoring wall, dewatering system, and soil settlement monitoring system.
- Excavated and leveled area outside the secant wall. Excavated interior secant wall in preparation for storage tank excavation and construction.

2014 Challenges and Corrections:

- Sealing of secant wall to prevent groundwater leakage into the site and settlement of structures outside of the site. Contractor was required to use an injectable grout at each of the leaking shoring system seams; this was a time and labor intensive activity.
- Project required King County construction management and project team members to maintain a high degree of vigilance in monitoring the project work.

2015 Activities in Progress or Expected:

- Placement of buoyancy slab and tank floor slab.
- Placement of storage tank walls.
- Facility building construction, utilities installation, mechanical and electrical installation.
- Upgrade of the Murray pump station.

CD/CSO Report Project Status –
North Beach Combined Sewer Overflow Control Facility (North Beach)

CSO(s): DSN 046 a & b North Beach

Project Description: Construct CSO Storage Tank. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/NBeachCSOStorage.aspx

Milestones	CD Milestone Date	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Submission of Facilities Plan	N/A	Draft Submitted 12/31/2010 Final Submitted 9/2011										
Submission of Final Plans & Specifications	12/31/2012											
Start of Construction	12/31/2013											
Construction Completion	12/31/2015											
Achievement of Performance Standard	12/31/2016											

2014 Accomplishments:

- Started construction.
- Completed utility relocations, shoring, and excavation for the storage tank and mechanical/ electrical building.
- Started concrete pours for the storage tank and mechanical/electrical building.

2014 Challenges and Corrections:

- The start of construction required several major changes in the neighborhood, including a Metro bus reroute, road closures, and limited access to a park. The community relations team responded by enhancing proactive communication with the public.

2015 Activities in Progress or Expected:

- Complete pouring of storage tank walls and top.
- Complete construction of mechanical/electrical building.
- Reinstall water, electrical, and communications lines.
- Repaving and reopening of road to Metro bus, neighborhood traffic, and pedestrian access.
- Complete construction by the end of 2015.

CD/CSO Report Project Status –
Rainier Valley Wet Weather Storage Facility

CSO(s): DSN 031 Hanford #1 (Hanford @ Rainier, Bayview N. & Bayview S.)
Project Description: Construct CSO Storage Tank and Conveyance Improvements. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/HanfordCSO.aspx

Milestones	CD Milestone Date	2013	2014	2015	2016	2017	2018	2019	2020
Submission of Facilities Plan	12/31/2014	Submitted 2/2014							
Completion of Bidding	12/31/2016								
Construction Completion	12/31/2019								
Achievement of Performance Standard	12/31/2020								

2014 Accomplishments:

- Completed SEPA determination.
- Completed 60 and 90 percent design.
- Submitted Draft Facility Plan.
- Received 60 percent approval on Department of Transportation Street Improvement Permit.

2014 Challenges and Corrections:

- Condemnation process at Bayview site took longer than anticipated; original condemnation request was not approved, requiring a secondary review and approval.
- Condemnation resolution expected by September 2015.

2015 Activities in Progress or Expected:

- 100 percent design on schedule to be completed June 2015.
- Construction contract will be advertised in September 2015 and awarded in February 2016.
- Construction Management contract will be awarded the third quarter of 2015.

CD/CSO Report Project Status –
South Magnolia Combined Sewer Overflow Control Facility (Magnolia)

CSO(s): DSN 006 S. Magnolia

Project Description: Construct CSO Storage Tank and New Conveyance. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/SMagnoliaCSOStorage.aspx

Milestones	CD Milestone Date	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Submission of Facilities Plan	N/A	Draft Submitted 12/31/2010 Final Submitted 9/2011										
Submission of Final Plans & Specifications	12/31/2012											
Start of Construction	12/31/2013											
Construction Completion	12/31/2015											
Achievement of Performance Standard	12/31/2016											

2014 Accomplishments:

Storage Facility

- Completed Milestone 1 activities, including sewer connection crossing under Magnolia Bridge, 23rd Avenue W Conveyance Pipeline Crossing, and installation of electrical duct bank.
- Completed installation of shoring system for tank and excavation of storage facility.
- Managed and addressed inadvertent discovery of historical items working with Ecology and Department of Archaeology and Historic Preservation.
- Completed mass concrete pour for the base slab.

Conveyance Pipeline:

- Completed construction of the Horizontal Directional Drilling (HDD) installation pits in Smith Cove Park and 32nd Avenue W.
- Completed the installation of the pipeline by pulling through the borehole in one weekend.

2014 Challenges and Corrections:

- Maintaining schedule while accommodating a supplemental treatment plan for the discovery of early 20th century historic artifacts. Supplemental treatment plan was implemented successfully, mitigating impacts to historical resources.
- Scheduling pipeline crossing under ramps and accommodating safety requirements.
- Scheduling a 3-day continuous concrete pour; pour occurred in less than 30 hours.

2015 Activities in Progress or Expected:

Storage Facility

- Complete construction of the concrete structure, including walls, columns, lid, ancillary facility, and lower diversion structure.
- Complete installation of mechanical and electrical equipment.

- Complete site restoration.
- Operational and system testing of equipment.
- Complete communication link test with upper diversion structure on conveyance pipeline project.

Conveyance Pipeline

- Complete construction of diversion structure and flow diversion vaults.
- Installation of mechanical and electrical equipment.
- Roadway and site restoration, including construction of retaining wall.
- Landscape restoration.
- Operational and system testing of equipment.
- Complete communication link test with storage facility systems.

3.2 Supplemental Plan Summaries

A supplemental compliance status page for each active project follows.

CD/CSO Report Supplemental Compliance Plan Status – Dexter

CSO(s): DSN 009 Dexter Regulator

Project Description**:** Adjust facilities built in 2005 to achieve final control per the Supplemental Compliance Plan included in the 2011 TM 970, and updated to Ecology and EPA in 2012. Several years of control system adjustments (followed by measuring success in the next wet season) did not achieve control. Alternatives analysis was described in the Supplemental Compliance Plan included in the 2011 TM 970, and updated to Ecology and EPA in 2012. Modifications to the diversion structure to the Mercer Tunnel were selected to increase the upstream diversion of central trunk flows.

2014 Accomplishments:

- Completed modifications (September 2014) to diversion structure to increase flow to the Mercer Tunnel.

2014 Challenges and Corrections:

- None.

2015 Activities in Progress or Expected:

- Performance will be monitored. As required in the CD, King County will report control status through 2015 in the 2016 Annual Consent Decree Report. In addition, King County will document the 20-year average based on the remodeled changed system facilities for the previous 20-year rainfall pattern in the same report. If compliance cannot be achieved by that time, a supplemental compliance plan will be submitted by August 31, 2016. Post-construction monitoring will be implemented.

CD/CSO Report Supplemental Compliance Plan Status – Denny

CSO(s): DSN 027a Denny Regulator
Project Description: Adjust facilities built in 2005 to achieve final control per the Supplemental Compliance Plan included in the 2011 TM 970, and updated to Ecology and EPA in 2012. Investigation suggested that two of the inputs—Denny Local and Denny Lake Union—were overflowing more than intended. The investigation recommended removal of the lower Denny local weir and modification of the Elliott West pump ramp-up strategy to drop the lead pump start set point by 2.25 feet and improve flow into the Elliott West facility. The weir modifications were completed in July 2011 and pumping strategy modifications were completed November 17, 2011.

2014 Accomplishments:

- In 2011, only two overflows, one 14 minutes and another two minutes long, occurred. In 2012, a single two-minute overflow occurred, and in 2013, two overflows occurred with one only lasting five minutes and discharging 34 gallons. In 2014, one overflow lasting 18 minutes and discharging 151,719 gallons. Performance of these improvements will continue to be monitored.

2014 Challenges and Corrections:

- None

2015 Activities in Progress or Expected:

- Performance of these improvements will continue to be monitored and additional adjustments will be investigated. As required in the CD, King County will report control status through 2015 in the 2016 Annual Consent Decree Report. In addition, King County will document the 20-year average based on the remodeled changed system facilities for the previous 20-year rainfall pattern in the same report. If compliance cannot be achieved by that time, a supplemental compliance plan will be submitted by August 31, 2016. Post-construction monitoring will be implemented.

CD/CSO Report Supplemental Compliance Plan Status – Harbor

CSO(s): DSN 037 Harbor Regulator
Project Description: Adjust facilities built in 1998 to achieve final control per the Supplemental Compliance Plan submitted to Ecology and EPA in August 2012, and, amended in September 2012. It was determined that failed modulation of the Alki Gate to the West Seattle tunnel resulted in less tunnel storage capacity being available to store Harbor flows – half of the tunnel capacity was to be available. Locking the gate partly 51% open was recommended.

2014 Accomplishments:

- There was one overflow in 2014 lasting one minute and discharging 5,921 gallons.

2014 Challenges and Corrections:

- None

2015 Activities in Progress or Expected:

- Performance will be monitored. As required in the CD, King County will report control status through 2015 in the 2016 Annual Consent Decree Report. In addition, King County will document the 20-year average based on the system facilities for the previous 20-year rainfall pattern in the same report. If compliance cannot be achieved by that time, a supplemental compliance plan will be submitted by August 31, 2016. Post-construction monitoring will be implemented.

3.3 Program Plan Summaries

The CD required development and implementation of two plans: the Sewer System Operations Plan (SSOP) and the Joint Operations and System Optimization Plan (Joint Plan) with the City of Seattle. In addition, King County and the City of Seattle have worked together for many years to identify joint projects and operational opportunities to improve each agency's CSO control efforts.

3.3.1 Sewer System Operations Plan

The CD required the County to submit its SSOP for Ecology and EPA approval within 90 days of the effective date of the CD. The County met this milestone through the submittal of its SSOP on September 27, 2013. Ecology and EPA approved the SSOP on May 29, 2014 and July 29, 2014, respectively. The SSOP is an electronic, interactive document with imbedded links to the most current base documents, such as O&M manuals, plant manuals, safety plans, and maps. King County staff typically access the SSOP from the County's intranet site. Portable storage device (thumb drive) versions are also provided at each facility and to key staff for access in the field or from home. Once a year in August, the team representatives of Operations, Offsite, and CSO control planning go over the plan to ensure that the electronic links still work. And every third year (beginning in 2016), the team will review the SSOP to ensure that base documents are being updated as needed and that any new or changed information is reflected in the SSOP. Thumb drives are replaced as needed.

Training was provided in 2014 to West Point Treatment Plant staff, individual groups within the division, and to each capital project team including consultants and contractors.

3.3.2 Joint Operations and System Optimization Plan between Seattle and the County

The City of Seattle's and King County's CDs each contain language directing both agencies to work together to develop a single Joint Plan to be submitted no later than March 1, 2016. In 2014, the Joint Plan team built on the work completed in 2013 by focusing on four CSO Joint Plan basins in the City of Seattle that have the greatest potential for operational optimization. Over the course of the year, staff from both King County's WTD and Seattle Public Utilities participated in a detailed options analysis process, which will result in operational optimization actions for possible inclusion in the final Joint Plan. The 2014 Joint Plan Annual Progress Report was submitted to EPA and Ecology on December 22, 2014. Highlights of the year included the following:

- Identified four basins in the City with the greatest potential for operational optimization – Montlake, University, West Duwamish, and SODO. These basins contain facilities where operational optimization is possible, have benefit to both agencies, and have potential for improved capacity management. The remaining basins will be examined in future updates to the Joint Plan.
- Began an options analysis process in each basin to identify, analyze, and select optimization strategies for potential inclusion in the Joint Plan.

- Completed brainstorming workshops for each basin with staff from both agencies. Over 200 operational optimization ideas were brainstormed across the 4 basins. Many of the optimization ideas were applicable to multiple basins in the City.
- Completed a consolidation and refinement process that shaped over 200 optimization ideas into 16 optimization alternatives for detailed analysis.
- Reviewed performance data for two historical storm events in each basin to gain a detailed understanding of how the two CSO systems work independently and together.
- Began detailed analysis of 16 alternatives (8 basin-specific and 8 multi-basin), which includes consideration of:
    - technical feasibility
    - cost
    - risk
    - regulatory implications
    - schedule for implementation
    - measures of success
- Developed and approved Early Action Number 3 (Operational Data Sharing Pilot) for implementation. Early Action Number 3 established a framework for real-time data sharing and resulted in development of a secure connection between WTD's and Seattle's SCADA systems. This is the first time that the two agency's SCADA systems have been sharing data with the other, and the first time that staff has had access to real-time data from both systems. Data shared in the pilot is from the University/Windermere basin where both WTD and Seattle have pump stations and CSO control facilities, and the potential for operational optimization and reduction of CSOs and sewer overflows may be high.

3.3.3 King County Coordination with City of Seattle CSO Control Projects

Similar to the County, the City of Seattle is implementing CSO control projects under their NPDES permit and CD. Unless these projects involve separation or GSI, Seattle projects will send captured CSO flows to the King County regional system for treatment at West Point Treatment Plant or at satellite CSO plants. The two agencies have been working together for many years to identify joint project and operational opportunities to improve each agency's efforts and better protect the environment. King County and the City of Seattle have agreed to guiding principles to ensure that neither agency will adversely impact the compliance of the other. The following City of Seattle projects have recently begun sending captured CSO flows to the regional system or will in the near future:

- South Henderson basin – NPDES 47C: construction completed October 2013 with flows to the regional system in December 2013.
- South Henderson basin – NPDES 47B/171: construction completed September 2014 with flows to the regional system in September 2014.
- Windermere basin – NPDES 13 and 15: construction complete in early 2015 with flows to the regional system in March 2015.

- Genesee basin – NPDES 40/41 and 43: construction complete in early 2015 with flows to the regional system in January 2015.

King County has been modeling flows from Seattle to the 30th and Belvoir basins and determined that past City of Seattle modifications have been contributing additional flows to the regional system. King County and the City of Seattle are working together to address the impacts to the regional system from these flows and from future flows from North Union Bay and Windermere.

Verification monitoring is underway for all projects. The County will continue working with Seattle on control and operational strategies as Seattle starts up the remaining components of the Henderson, Genesee, and Delridge projects, and as they finalize the Leschi project.

4.0 Summary of Rainfall and CSO Events

King County measures rainfall in the Seattle area at several of its regulator and pump stations and at the West Point Treatment Plant. It also monitors the frequencies and volumes of both untreated and treated CSOs at all of its CSO discharge sites.

This section describes rainfall data, reports on unpermitted overflows, and summarizes frequency and volume for all untreated and treated CSO discharges in 2014. Additional information can be found in the Appendices.

4.1 Annual Rainfall

Rainfall data is reported for each CSO event as measured by the nearest King County owned rain gauge. Rainfall data for 2014 are included in Appendices A and B of this annual report.

The annual rainfall for 2014, as an average over local rain gauges, was 42.24 inches, which is greater than the 20-year Sea-Tac annual average of 37.27 inches. March (9.44 inches) and October (6.75 inches) had the highest rainfall.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures, broken pipelines, and manholes. Overflows in the combined system that are not caused by rainfall are called dry-weather overflows (DWO). In King County's system, when DWOs occur, they usually result from mechanical failures, power outages, or human error. Under EPA's Nine Minimum Controls, DWOs are to be prevented. Overflows that occur during precipitation, but are worsened by mechanical failures, power outages, or human error, are referred to as "exacerbated CSOs." Overflows that occur during precipitation, but are caused by mechanical failures, power outages, or human error, and not high volumes due to rain, are referred to as sanitary sewer overflows (SSO). An SSO can mean any overflow, spill, diversion, or release of wastewater from or caused by the Sanitary Sewer System or the Combined Sewer System upstream of a County's CSO Outfall.

No DWOs or exacerbated CSOs occurred in the County system in 2014. There were two SSOs, which are shown in Section 5.0.

4.3 Annual Untreated CSO Events

Appendix A lists the untreated events from County CSOs during 2014. These data are also provided in electronic form to Ecology with this report.

West Point Treatment Plant's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at 11 CSO locations not currently monitored by SCADA: 11th Avenue NW, 30th Avenue NE, SW Alaska Street, Bayview North and South, East and West

Duwamish, Hanford at Rainier, South Magnolia, North Beach Pump Station inlet, and Terminal 115. Portable meters also supplement SCADA in a few locations.

With higher than normal rainfall, King County CSOs discharged a total of 1,140 MG over 388 events during 2014. This single year's data represents a 52 percent reduction from the 1981-1983 baseline volume of 2,339 MG, but does not reflect the long-term trend of reduction. The most storm events and the highest precipitation (7.64 inches) as well as the highest volume (306 MG) occurred in March. The second highest precipitation occurred in October (5.9 inches), however, February had more overflow events (53 versus 47) and a much higher overflow volume (214 MG versus 111 MG).

The NPDES permit also requires reporting against the performance standard of no more than one untreated event per year by site as a 20-year moving average. Section 6 of this report presents performance against this 20-year standard.

4.4 CSO Treatment

King County provides CSO treatment, defined in Chapter 173-245 WAC as "equivalent to primary" treatment and disinfection, at the West Point Treatment Plant for flows above its secondary capacity of 300 MGD and at four satellite facilities: Alki, Carkeek, Mercer/Elliott West, and Henderson/MLK.

The following sections summarize performance and compliance at each facility during 2014. Appendix B of this report provides more detail on volumes and events. Appendices C–F contain the annual reports for each satellite CSO treatment facility.

4.4.1 West Point CSO-related Bypass

In addition to secondary treatment of up to 300 MGD of base wastewater flows (defined as 2.25 times the average wet-weather flow of 133 MGD), the West Point Treatment Plant provides CSO/primary treatment for flows above 300 MGD and up to a peak of 440 MGD. Combined sewer flows that would otherwise overflow to surface waters are transferred to the West Point Treatment Plant. After receiving CSO treatment, these flows are blended with secondary effluent prior to disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small reduction—80 percent instead of 85 percent—in the monthly removal requirements during the typical wet season months of November through April. WTD submitted, and Ecology accepted, documentation that there are no feasible alternatives to this practice as it is a fundamental component to King County's CSO control strategy.

The West Point Treatment Plant had 25 CSO-related bypasses during 2014. The total volume was 563.3 MG. All occurred when total plant flows were above 300 MGD, and the final blended effluent met NPDES limits. The West Point Treatment Plant also had one equipment related bypass (September 2, 2014) on a day when flows were above 300 MGD; the total volume on that day was 4.4 MG. All occurrences are listed in Appendix B.

4.4.2 Alki CSO Treatment Plant

The transfer of Alki area base flows to the West Point Treatment Plant was completed in 1998 and conversion of the Alki Treatment Plant from a continuously operating primary plant to a CSO treatment plant was completed in 2001. There were eight filling events and six discharge events at the Alki CSO Treatment Plant during 2014. The plant received a total inflow of 90.7 MG and discharged 71.4 MG.

Overall TSS removal was 48.7 percent, which did not meet the annual 50 percent TSS removal limit. The NPDES permit allows the removal of one event per year as the "one untreated discharge per year." After removing the March 4-6 event, the annual average TSS removal was 51 percent. The annual average settleable solids (SS) was 0.22 milliliter per liter per hour (ml/L/hr), which is less than the limit of 0.3 ml/L/hr. The Alki CSO Treatment Plant exceeded its maximum monthly geomean fecal coliform limit for one month (February) and its maximum daily average total residual chlorine (TRC) limit on one day (February 17). The Alki CSO Treatment Plant also fell below an instantaneous minimum pH of less than 6.0 on two discharge days – January 11 and February 16, 2014.

More detail is available in the Alki CSO Treatment Plant Annual Report in Appendix C.

4.4.3 Carkeek CSO Treatment Plant

The transfer of Carkeek area base flows to the West Point Treatment Plant and the conversion of the Carkeek Treatment Plant from a continuously operating primary plant to a CSO treatment plant was completed in 1994. In 2014, the Carkeek CSO Treatment Plant operated 17 times with a total inflow volume of 10.9 MG, and discharged three times with a total discharge volume of 8.1 MG.

The annual average solids removal, as measured by the TSS percent removal, was 68.3 percent, meeting the NPDES permit limit of 50 percent. One discharge day (February 16) fell below the instantaneous minimum pH permit limit of less than 6.0. All remaining parameters met NPDES permit limits.

More detail is available in the Carkeek CSO Treatment Plant Annual Report in Appendix D.

4.4.4 Mercer/Elliott West CSO Treatment and Storage Facilities

The Mercer/Elliott West tunnel storage and treatment system was brought online in May 2005 as a joint project with Seattle's East Lake Union CSO control projects. In 2014, there were 34 filling events totaling 467.9 MG and 12 discharge events, with a total volume of 131.9 MG. Elliott West continues in the commissioning phase as needed corrections are identified and implemented across intermittent operations.

The 50 percent annual average TSS removal limit was met, with a removal of 60.9 percent. The annual average SS limit of 0.3 ml/L/hr was not met, with a SS of 1.93 ml/L/hr. The TRC was not met on seven days (February 18, July 23, August 12 and 13, October 31, November 28, and December 23) and the

instantaneous minimum pH was not met on six days (February 17 and 18, March 5, October 22 and 31, and November 28).

More detail can be found in the Mercer/Elliott West Annual Report in Appendix E.

4.4.5 Henderson/MLK CSO Treatment and Storage Facilities

The Henderson/MLK tunnel storage and treatment system was brought online in May 2005. The Henderson/MLK system had six filling events totaling 10.27 MG and two discharge events to the Duwamish Waterway totaling 0.91 MG. All NPDES permit performance conditions were met, except for exceeding the TRC maximum limit once during the March 4-5 event.

The annual report for Henderson/MLK system is provided in Appendix F.

5.0 Summary of Consent Decree Violations in 2014

Section VIII. 43 of the CD requires the listing of any violations of the CD in the annual report. The following table identifies CD violations in 2014. Detail on causes and corrective actions are provided in the facility annual reports in the Appendices.

Date of Event	Facility	Description of Violation(s)	Date of Verbal Notification (if required)	Date of 10-day Letter
1/11/2014	Elliott West	pH, chlorine residual	1/12/2014	1/22/2014
1/11/2014	Alki	pH	1/12/2014	1/22/2014
1/11/2014	Murray	SSO due to power failure	Within 24 hours of becoming aware delayed chlorine application	1/24/2014
2/10/2014	West Point	Secondary diversion	Within 24 hours of becoming aware	2/20/2014
2/16/2014	Carkeek	pH	2/17/2014	2/27/2014
2/16/2014-2/17/2014	Alki	pH, fecal coliform	3/6/2014	3/18/2014
2/18/2014	Elliott West	pH, max daily total chlorine residual	Within 24 hours of becoming aware	2/28/2014
3/5/2014-3/8/2014	Elliott West	pH, max daily total chlorine residual, settleable solids	3/6/2014	3/18/2014
5/3/2014	Elliott West	Settleable solids	5/4/2014	5/14/2014
7/23/2014	Elliott West	pH, max daily total chlorine residual, settleable solids	7/24/2014	8/2/2014
8/12/2014-8/13/2014	Elliott West	Max daily total chlorine residual, settleable solids	8/14/2014	2/22/2014
10/25/2014	Murray	SSO during power outage	10/26/2014	11/4/2014
10/31/2014	Elliott West	pH, total chlorine residual	11/12014	11/7/2014

6.0 Twenty-Year Moving Average of Event Frequencies

The NPDES permit for the West Point Treatment Plant, effective July 1, 2009, implemented a new interpretation of the performance standard for CSO control, which is derived from the state regulatory requirements for "greatest reasonable reduction" as specified in WAC 173-245-022(22). The CD recognizes this performance level. This standard of "not more than one untreated discharge event per year per outfall on average" is based on a 20-year moving average. The number of untreated discharges that occurred over each of the previous 20 years is reported for each CSO site and then averaged (Table 2). This average is used each year to assess compliance with the performance standard for CSOs identified as controlled. However, since the upgraded SCADA system was brought online and began to report data for all sites over time, a full 20 years of data are not available for all sites. Locations lacking the full 20 years of measured data are noted. For sites where new control facilities have been built and, thus, lack the 20 years of measured data, modeled data of how the new facilities would have performed over those years of rainfall have been substituted for the early missing data. For sites not identified as controlled, only available measured data are reported.

The following 17 CSOs were identified as controlled through the monitoring and modeling data:

30th Avenue NE Pump Station[1]	West Duwamish Siphon
53rd Avenue SW Pump Station	Henderson Pump Station
63rd Avenue SW Pump Station	East Marginal Pump Station
8th Ave S Regulator[1]	Matthews Park Pump Station
SW Alaska Street	Martin Luther King Way (MLK)
Ballard	Norfolk
Belvoir Pump Station[1]	E Pine Street Pump Station
Canal Street	Rainier Avenue Pump Station.
East Duwamish Pump Station and Siphon	

[1] Modeled and monitored data at 30th Ave NE, 8th Ave S, and Belvoir do not agree on control status. Additional monitors have been placed to update data for the next recalibration of the model. The control status of 30th Ave NE, 8th Ave S, and Belvoir will be confirmed at that time.

Projects previously completed at three CSO sites—Denny Regulator, Dexter Regulator, and Harbor Regulator—have not fully achieved control to the state standard. Work completed or currently under way to complete control is described in Section 3.1 of this report.

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Table 2. Untreated CSO Events, Averages, and Baselines, 1995–2014

CSO Site	Discharge Serial Number (DSN)	1995	1996	1997 [a]	1998	1999	2000 [b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	20-Year Average [c]	1983 Baseline (24-hr inter-event)
11th Ave NW [d]	004	30	18	21	10	12	14	14	8	8	6	11	22	10	7	16	19	16	20	12	25	15.0	16
30th Ave NE	049	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0	2	1.0	0
3rd Ave W [e]	008	10	15	9	8	4	1	11	4	6	4	5	13	6	3	9	8	7	13	5	12	7.7	17
53rd Ave SW [f]	052	NM	NM	NM	NM	NM	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0.3	<1
63rd Ave [f]	054	NM	NM	NM	NM	NM	0	0	0	2	0	1	0	0	0	0	1	1	3	2	2	0.8	2
8th Ave / W Marginal Way	040	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.2	6
Alaska St. SW [d]	055	0	0	0	0	0	0	0	0	0	0	0	1	1	1[t]	0	1	1	1	0	0	0.3	1
Ballard [g]	003	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	2	0.3	13
Barton [f]	057	NM	NM	NM	NM	NM	0	0	0	3	4	5	11	3	1	2	4	1	4	5	11	3.6	9
Belvoir	012	0	1	1	0	1	0	0	0	2	2	0	1	1	0	0	1	0	1	1	1	0.7	0
Brandon St. [h]	041	53	55	40	31	32	30	30	21	28	21	27	11	NM	3	16	11	7	12	7	16	23.7	36
Canal St.	007	0	3	1	2	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0.6	0
Chelan	036	8	15	8	5	5	2	7	2	3	1	2	5	2	0	0	3	4	13	4	13	5.1	7
Denny Way	027a	49	54	37	23	23	25	26	15	25	20	11	9	1	2	4	2	2	1	2	1	16.6	32
Dexter	009	23	22	21	13	10	10	12	9	15	8	12	20	9	3	11	13	8	13	6	12	12.5	15
Duwamish E [d]	034	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0.2	0
Duwamish W [d,i]	035	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1	0	1	0	0	1	0	0	1	0	0.4	0
Hanford #1																							30
Hanford @ Rainier [d,j,k]	031a	NM	20[i]	14	17	5	0	0	3	6	8	NM	16	4	6	14	13	13	18	10	26	10.2	NA
Bayview South [d,l]	031b	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0	1	2	2	1.3	NA
Bayview North [d,m]	031c	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5	2	7	4	15	6.6	NA
Hanford #2	032	32	20	17	17	18	17	13	10	12	16	15	26	12	8	17	17	15	23	9	27	17.1	28
Harbor Ave [n]	037	47	39	1	1	0	0	2	0	2	0	3	5	2	0	0	1	1	3	2	1	5.5	30
Henderson [o]	045	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0.0	12
King Street	028	27	17	18	11	14	10	14	12	16	15	20	27	7	3	15	18	15	13	2	23	14.9	16
Kingdome (formerly Connecticut)	029	15	14	11	3	0	1	0	0	0	2	5	4	5	1	8	6	2	11	6	22	5.8	29
Lander St.	030	26	16	12	10	15	11	10	10	12	9	8	28	8	6	19	17	15	25	8	29	14.7	26
(S) Magnolia [d]	006	39	48	34	19	5	0	0	5	18	17	26	30	21	26	25	38	22	36	16	38	23.2	25

CSO Site	Discharge Serial Number (DSN)	1995	1996	1997 [a]	1998	1999	2000 [b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	20-Year Average [c]	1983 Baseline (24-hr inter-event)
Marginal E	043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Matthews Park	018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Michigan St.	039	0	0	0	0	10	8	12	8	9	6	5	13	5	3	10	12	14	16	8	26	8.3	34
Michigan W	042	5	6	6	3	3	2	7	5	4	1	3	8	4	0	8	9	3	5	2	3	4.4	5
MLK Jr. Way [o]	013	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0.0	16
Montlake	014	11	7	2	7	0	2	0	5	11	5	6	NM	0	1	3	10	8	18	7	20	6.5	6
Murray [f]	056	NM	NM	NM	NM	NM	0	0	0	3	5	10	10	3	1	11	8	3	5	2	3	4.3	5
Norfolk St.[o]	044a	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0.0	20
North Beach Inlet [d]	048b	19	22	20	13	9	11	10	1	6	6	10	13	4	3	13	6	15	13	3	14	10.6	18
North Beach Wet Well [p]	048a	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	3	15	6	3	14	10	8	20	13	29	12.1	18
(E) Pine St.	011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Rainier Ave	033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0
Terminal 115 [d,q]	038	NM	NM	NM	NM	NM	NM	NM	NM	2	0	2	7	4	0	3	3	0	1	1	0	1.9	4
University	015	15	13	9	10	4	3	5	4	4	4	3	12	5	3	9	8	6	13	4	14	7.4	13
Rainfall (inches)		39.34	42.2	35.23	41.32	33.81	29.82	35.99	27.39	34.46	27.79	31.32	42.82	31.11	24.90	31.46	40.3	32.2	42.57	24.93	42.24	34.6	37

Notes:

[a] CSO “event” definition changed to be based on a 48-hour dry period.
[b] CSO “event” definition changed to be based on a 24-hour dry period.
[c] Blue 20-year averages are those that meet the no more than one event per year on a 20-year average.
[d] Portable monitors are used at 11th Ave NW, 30th Ave NW, Alaska Street SW, Bayview North and South, East and West Duwamish, Hanford @ Rainier, S Magnolia, North Beach Inlet, and Terminal 115. The Bayview North monitor was installed in 2010; the Bayview South monitor was installed in 2011.
[e] The 3rd Ave W monitor was down June 2006 through November 2006.
[f] Monitoring began in June 2000 at 53rd Ave, 63rd Ave, Barton, and Murray.
[g] Years 1995-2013 are modeled data and numbers may be updated in future reports as new information is gathered. Modeled data (in italics) have been substituted to simulate how current facilities would have performed under rain patterns during that time.
[h] The monitor at Brandon was down June 2006 to March 2008. A portable monitor was installed in March 2008. Monitoring by SCADA was restored beginning with the 2009 period.
[i] Monitoring began at West Duwamish in June 2005.
[j] Monitoring began at Hanford #1 (Hanford @ Rainier) in January 1996.
[k] The monitor at Hanford #1 was down June 2000 through May 2001 and was not operating properly June 2007 to December 2007. From June 2005 to May 2006 the portable meter provided questionable data.
[l] Hanford #1 (Bayview S) began monitoring in 2011.
[m] Hanford #1 (Bayview N) began monitoring in 2010.
[n] No data were recorded at Harbor Ave in April and May 2004.
[o] Henderson, MLK Jr. Way, and Norfolk Street were controlled as of 2006. Modeled data through 2005 (in italics) have been substituted to simulate how current facilities would have performed under rain patterns during that time.
[p] Monitoring began in June 2005 at North Beach wet well.
[q] Monitoring began in June 2003 at Terminal 115.

7.0 Post-Construction Monitoring

King County's Post-Construction Monitoring Plan (PCMP) was approved by Ecology on September 28, 2012. Volume and frequency of overflow monitoring at the controlled untreated discharges listed above is on-going and is reported monthly to Ecology and summarized in each annual report (Table 2, and Appendix A and B). Volume, frequency, and NPDES permit effluent monitoring and effluent compliance for the CSO treatment facilities is reported monthly and then summarized in Appendix B and the facility annual reports presented in Appendices C-F of this annual report.

King County's ongoing ambient monitoring program provides data for post-construction monitoring as described in the PCMP. Additional details can be found in Appendix D (Receiving Water Characterization Study Sampling and Analysis Plan and Quality Assurance Project Plan), Appendix E (Major Lakes Sampling and Analysis Plan), and Appendix F (Freshwater Swimming Beach Monitoring Sampling and Analysis Plan) of the PCMP.

Sediment monitoring for controlled sites is being performed as described in the PCMP. Details can be found in Appendix C (Sampling and Analyses Plan) of the PCMP. Sediment characterization data for 2012 was submitted to Ecology in April 2014. The Sediment Management Plan Update, which will contain modeling results for those CSOs not proposed to be sampled, will be available for review in 2016.

Appendices

Appendix A. Untreated CSO Events, January–December 2014

Appendix B. Treated CSO Events, January–December 2014

Appendix C. Alki CSO Treatment Plant 2014 Annual Report

Appendix D. Carkeek CSO Treatment Plant 2014 Annual Report

Appendix E. Mercer/Elliott West CSO Control Facilities 2014 Annual Report

Appendix F. Henderson/MLK CSO Control Facilities 2014 Annual Report

Appendix A
Untreated CSO Events

January–December 2014

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	1/29/14 1:17 AM	1/29/14 3:02 AM	1.75	139,752	0.74	6.08	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	3/10/14 1:21 PM	3/10/14 1:23 PM	0.03	11,756	0.57	16.28	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/8/14 4:34 PM	1/8/14 4:52 PM	0.30	48,018	0.71	40.48	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/11/14 4:33 AM	1/11/14 3:14 PM	10.68	1,264,644	1.07	19.37	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/29/14 12:55 AM	1/29/14 12:42 PM	11.78	320,447	0.92	15.72	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/16/14 6:28 PM	2/17/14 12:21 AM	5.88	2,159,634	1.47	35.82	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/18/14 10:23 AM	2/18/14 11:42 AM	1.32	144,560	0.31	4.77	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/2/14 5:13 PM	3/2/14 7:40 PM	2.45	610,605	0.91	29.57	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/5/14 2:06 AM	3/5/14 8:22 PM	18.27	2,080,293	2.94	102.2	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/8/14 1:33 PM	3/8/14 6:54 PM	5.35	394,422	0.79	7.73	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/10/14 1:19 PM	3/10/14 2:04 PM	0.75	258,943	0.60	16.45	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/16/14 6:55 PM	3/16/14 9:20 PM	2.42	181,611	1.09	27.47	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/29/14 8:06 AM	3/29/14 7:50 PM	11.73	287,845	1.04	37.63	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	4/17/14 10:10 PM	4/17/14 10:21 PM	0.18	1,722	0.49	67.50	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	5/3/14 9:44 PM	5/4/14 4:32 PM	18.80	140,260	1.12	33.58	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	7/23/14 12:06 PM	7/23/14 12:12 PM	0.10	1,080	0.41	7.67	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	8/13/14 12:50 AM	8/13/14 3:06 AM	2.27	97,338	0.7	3.75	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/2/14 6:39 PM	9/2/14 7:07 PM	0.47	579,947	0.57	7.00	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/24/14 7:38 AM	9/24/14 7:53 AM	0.25	6,357	1.16	18.87	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/22/14 10:25 AM	10/22/14 9:13 PM	10.80	194,356	1.24	19.47	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/30/14 7:55 PM	10/31/14 9:54 AM	13.98	358,798	1.41	24.42	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/6/14 8:14 AM	11/6/14 8:53 AM	0.65	339,637	0.69	19.30	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/23/14 7:04 AM	11/23/14 8:12 AM	1.13	657,792	0.46	5.77	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/28/14 8:29 AM	11/28/14 2:24 PM	5.92	668,725	1.15	14.40	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/10/14 2:13 AM	12/10/14 3:17 AM	1.07	265,753	1.30	49.50	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/11/14 1:48 PM	12/11/14 2:04 PM	0.27	13,883	1.97	84.13	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/23/14 3:29 PM	12/23/14 8:24 PM	4.92	97,778	0.82	5.43	
006	Magnolia Overflow	Elliott Bay/Puget Sound	1/2/14 8:35 PM	1/2/14 10:20 PM	1.75	414,023	0.56	23.85	
006	Magnolia Overflow	Elliott Bay/Puget Sound	1/8/14 4:20 PM	1/8/14 4:50 PM	0.50	67,435	0.79	40.50	
006	Magnolia Overflow	Elliott Bay/Puget Sound	1/10/14 11:05 PM	1/11/14 3:20 PM	16.25	520,188	0.75	19.80	
006	Magnolia Overflow	Elliott Bay/Puget Sound	1/28/14 10:50 PM	1/29/14 3:00 PM	16.17	422,485	0.91	18.07	
006	Magnolia Overflow	Elliott Bay/Puget Sound	2/10/14 5:40 AM	2/10/14 8:25 AM	2.75	66,968	0.61	34.67	
006	Magnolia Overflow	Elliott Bay/Puget Sound	2/11/14 8:30 PM	2/11/14 11:30 PM	3.00	96,117	0.59	8.26	
006	Magnolia Overflow	Elliott Bay/Puget Sound	2/16/14 6:10 PM	2/17/14 1:00 AM	6.83	1,354,493	1.64	37.00	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
006	Magnolia Overflow	Elliott Bay/Puget Sound	2/18/14 10:00 AM	2/18/14 2:35 PM	4.58	248,476	2.30	74.20	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/2/14 4:25 PM	3/3/14 9:15 AM	16.83	583,835	1.06	43.39	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/4/14 7:35 PM	3/6/14 1:50 AM	30.25	1,443,919	2.87	107.89	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/8/14 12:30 PM	3/8/14 9:30 PM	9.00	354,142	1.00	10.49	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/10/14 3:00 AM	3/10/14 3:05 AM	0.08	30	1.37	40.07	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/16/14 7:15 PM	3/16/14 9:35 PM	2.33	320,408	1.00	26.61	
006	Magnolia Overflow	Elliott Bay/Puget Sound	3/29/14 7:50 AM	3/29/14 7:45 PM	11.92	301,929	0.82	37.17	
006	Magnolia Overflow	Elliott Bay/Puget Sound	4/17/14 7:25 PM	4/17/14 7:40 PM	0.25	4,659	0.69	64.60	
006	Magnolia Overflow	Elliott Bay/Puget Sound	5/3/14 4:10 PM	5/4/14 4:25 PM	24.25	435,309	1.22	26.68	
006	Magnolia Overflow	Elliott Bay/Puget Sound	5/18/14 7:00 PM	5/18/14 7:45 PM	0.75	42,649	0.04	0.24	
006	Magnolia Overflow	Elliott Bay/Puget Sound	7/23/14 11:55 AM	7/23/14 12:45 PM	0.83	135,750	0.35	6.12	
006	Magnolia Overflow	Elliott Bay/Puget Sound	8/13/14 12:40 AM	8/13/14 4:10 AM	3.50	572,953	0.75	19.17	
006	Magnolia Overflow	Elliott Bay/Puget Sound	9/2/14 9:25 PM	9/2/14 9:45 PM	0.33	103,790	1.4	10.47	
006	Magnolia Overflow	Elliott Bay/Puget Sound	9/23/14 9:30 PM	9/24/14 8:45 AM	11.25	201,067	1.04	19.55	
006	Magnolia Overflow	Elliott Bay/Puget Sound	9/26/14 7:30 AM	9/26/14 7:50 AM	0.33	14,041	1.43	66.26	
006	Magnolia Overflow	Elliott Bay/Puget Sound	9/29/14 6:10 PM	9/29/14 6:30 PM	0.33	24,196	0.14	10.37	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/11/14 12:45 PM	10/11/14 1:00 PM	0.25	67,471	0.25	13.08	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/14/14 12:15 AM	10/14/14 2:20 AM	2.08	154,244	0.5	5.74	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/15/14 8:35 AM	10/15/14 8:50 AM	0.25	44,911	0.24	6.88	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/18/14 1:55 AM	10/18/14 2:30 AM	0.58	16,942	0.58	73.46	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/22/14 6:05 AM	10/23/14 4:05 PM	34.00	372,756	1.43	38.11	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/28/14 8:25 AM	10/28/14 10:20 AM	1.92	5,178	0.4	10.65	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/30/14 12:00 PM	10/31/14 10:15 AM	22.25	443,636	1.18	24.77	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/5/14 10:45 PM	11/6/14 9:00 AM	10.25	170,044	0.58	19.20	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/21/14 2:25 PM	11/21/14 3:00 PM	0.58	11,380	0.39	10.34	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/23/14 6:55 AM	11/23/14 8:15 AM	1.33	312,067	0.38	6.11	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/28/14 8:30 AM	11/28/14 5:00 PM	8.50	929,461	1.32	33.36	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/8/14 7:55 PM	12/8/14 9:05 PM	1.17	23,365	0.39	14.46	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/10/14 12:55 AM	12/11/14 2:05 PM	37.17	351,090	1.71	83.07	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/18/14 10:15 PM	12/18/14 11:10 PM	0.92	1,825	0.65	49.22	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/23/14 3:30 PM	12/23/14 10:15 PM	6.75	328,060	0.99	7.44	
007	Canal Street Overflow	Lake Washington Ship Canal	3/5/14 3:01 AM	3/5/14 3:13 AM	0.20	6,763	2.18	85.13	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/11/14 12:00 PM	1/11/14 11:14 PM	11.23	45,866	1.09	20.17	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/29/14 12:55 AM	1/29/14 5:54 AM	4.98	217,816	0.77	8.58	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	2/11/14 10:59 PM	2/11/14 11:29 PM	0.50	2,455	1.28	59.01	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	2/16/14 7:43 PM	2/17/14 12:55 AM	5.20	988,004	1.48	36.52	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	2/18/14 7:24 AM	2/18/14 8:23 PM	12.98	12,565	0.45	8.65	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	3/2/14 5:36 PM	3/2/14 8:08 PM	2.53	121,385	0.94	29.98	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	3/5/14 2:28 AM	3/5/14 8:29 PM	18.02	1,316,419	2.94	102.20	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	3/8/14 2:17 PM	3/8/14 9:41 PM	7.40	274,685	0.96	10.54	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	3/16/14 5:47 PM	3/16/14 9:54 PM	4.12	55,136	1.48	36.52	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	5/3/14 9:46 PM	5/3/14 10:45 PM	0.98	28,704	0.63	15.83	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	8/13/14 1:41 AM	8/13/14 3:49 AM	2.13	1145,216	0.78	4.37	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/28/14 9:40 AM	11/28/14 2:19 PM	4.65	90,363	1.15	14.40	
009	Dexter Ave Regulator	Lake Union	1/2/14 8:55 PM	1/2/14 10:30 PM	1.58	589,983	0.54	27.47	
009	Dexter Ave Regulator	Lake Union	1/8/14 4:41 PM	1/8/14 4:59 PM	0.30	1,810	0.87	40.43	
009	Dexter Ave Regulator	Lake Union	1/11/14 12:09 PM	1/11/14 12:49 PM	0.67	818,927	1.10	18.43	
009	Dexter Ave Regulator	Lake Union	1/29/14 1:15 AM	1/29/14 2:05 AM	0.83	39,809	0.73	5.33	
009	Dexter Ave Regulator	Lake Union	2/16/14 8:28 PM	2/17/14 12:02 AM	3.57	1,612,494	1.76	35.95	
009	Dexter Ave Regulator	Lake Union	3/5/14 2:23 AM	3/5/14 4:02 AM	1.65	1,486,663	2.05	86.12	
009	Dexter Ave Regulator	Lake Union	3/8/14 2:54 PM	3/8/14 3:16 PM	0.37	4,189	0.56	4.55	
009	Dexter Ave Regulator	Lake Union	3/29/14 8:43 AM	3/29/14 8:44 AM	0.02	27	0.67	26.72	
009	Dexter Ave Regulator	Lake Union	5/3/14 9:55 PM	5/3/14 10:26 PM	0.52	23,903	0.80	8.55	
009	Dexter Ave Regulator	Lake Union	7/23/14 12:25 PM	7/23/14 12:54 PM	0.48	73,285	0.39	7.38	
009	Dexter Ave Regulator	Lake Union	8/13/14 12:38 AM	8/13/14 1:47 AM	1.15	163,914	0.54	18.1	
009	Dexter Ave Regulator	Lake Union	9/2/14 7:05 PM	9/2/14 7:49 PM	0.73	112,276	0.55	11.97	
011	E Pine St. Pump Station Emergency Overflow	Lake Washington			0.00	0			
012	Belvoir Pump Station Emergency Overflow	Lake Washington	2/16/14 10:30 PM	2/17/14 1:18 AM	2.80	283,065	2.01	37.27	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
013	Martin Luther King Way Trunkline Overflow	Lake Washington via storm drain			0.00	0			
014	Montlake Overflow	Lake Washington Ship Canal	1/2/14 9:10 PM	1/2/14 10:30 PM	1.33	1,130,812	0.38	26.00	
014	Montlake Overflow	Lake Washington Ship Canal	1/11/14 4:45 AM	1/11/14 1:06 PM	8.35	2,532,171	0.93	17.05	
014	Montlake Overflow	Lake Washington Ship Canal	1/29/14 1:09 AM	1/29/14 2:24 AM	1.25	1,043,326	0.71	5.58	
014	Montlake Overflow	Lake Washington Ship Canal	2/16/14 8:09 PM	2/17/14 1:20 AM	5.18	8,005,502	2.01	37.27	
014	Montlake Overflow	Lake Washington Ship Canal	2/18/14 2:17 PM	2/18/14 2:51 PM	0.57	374,004	2.74	74.42	
014	Montlake Overflow	Lake Washington Ship Canal	3/2/14 5:32 PM	3/2/14 6:00 PM	0.47	498,835	0.64	28.62	
014	Montlake Overflow	Lake Washington Ship Canal	3/5/14 2:21 AM	3/5/14 8:21 PM	18.00	12,998,145	3.06	102.75	
014	Montlake Overflow	Lake Washington Ship Canal	3/8/14 2:37 PM	3/8/14 7:12 PM	4.58	2,184,223	0.84	7.77	
014	Montlake Overflow	Lake Washington Ship Canal	3/10/14 1:55 PM	3/10/14 2:40 PM	0.75	1,675,290	0.74	16.63	
014	Montlake Overflow	Lake Washington Ship Canal	3/16/14 7:43 PM	3/16/14 9:54 PM	2.18	1,770,672	1.28	26.93	
014	Montlake Overflow	Lake Washington Ship Canal	3/29/14 8:47 AM	3/29/14 8:59 AM	0.20	215,983	0.69	27.17	
014	Montlake Overflow	Lake Washington Ship Canal	5/3/14 7:36 PM	5/3/14 10:39 PM	3.05	1,314,417	0.81	8.60	
014	Montlake Overflow	Lake Washington Ship Canal	7/23/14 12:21 PM	7/23/14 1:04 PM	0.72	910,877	0.73	9.72	
014	Montlake Overflow	Lake Washington Ship Canal	8/13/14 12:45 AM	8/13/14 3:01 AM	2.27	1,198,837	0.82	29.55	
014	Montlake Overflow	Lake Washington Ship Canal	9/2/14 7:27 PM	9/2/14 7:40 PM	0.22	333,070	0.1	4.2	
014	Montlake Overflow	Lake Washington Ship Canal	10/11/14 1:03 PM	10/11/14 1:23 PM	0.33	428,577	0.15	0.27	
014	Montlake Overflow	Lake Washington Ship Canal	10/14/14 1:39 AM	10/14/14 2:14 AM	0.58	403,288	0.48	5.58	
014	Montlake Overflow	Lake Washington Ship Canal	10/31/14 8:42 AM	10/31/14 11:05 AM	2.38	2,408,147	1.38	25.53	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
014	Montlake Overflow	Lake Washington Ship Canal	11/6/14 8:36 AM	11/6/14 8:46 AM	0.17	200,600	0.66	19.28	
014	Montlake Overflow	Lake Washington Ship Canal	11/23/14 7:28 AM	11/23/14 8:20 AM	0.87	1,428,753	0.48	5.28	
014	Montlake Overflow	Lake Washington Ship Canal	11/28/14 8:56 AM	11/28/14 2:53 PM	5.95	7,874,410	1.28	31.25	
014	Montlake Overflow	Lake Washington Ship Canal	12/23/14 3:52 PM	12/23/14 11:21 PM	7.48	5,074,286	1.16	14.33	
015	University Regulator	Lake Washington Ship Canal	1/11/14 12:24 PM	1/11/14 3:28 PM	3.07	3,137,778	1.02	19.80	
015	University Regulator	Lake Washington Ship Canal	1/29/14 2:03 AM	1/29/14 2:30 AM	0.45	905,877	0.72	5.68	
015	University Regulator	Lake Washington Ship Canal	2/16/14 8:03 PM	2/17/14 1:22 AM	5.32	22,423,466	2.01	37.27	
015	University Regulator	Lake Washington Ship Canal	3/2/14 6:12 PM	3/2/14 7:52 PM	1.67	3,913,156	0.85	30.30	
015	University Regulator	Lake Washington Ship Canal	3/5/14 2:40 AM	3/5/14 7:32 AM	4.87	19,517,688	2.68	90.00	
015	University Regulator	Lake Washington Ship Canal	3/8/14 2:59 PM	3/8/14 9:44 PM	6.75	6,995,818	1.03	10.20	
015	University Regulator	Lake Washington Ship Canal	3/16/14 8:20 PM	3/16/14 9:58 PM	1.63	2,800,069	1.28	26.93	
015	University Regulator	Lake Washington Ship Canal	5/3/14 10:24 PM	5/3/14 10:48 PM	0.40	756,574	0.81	8.60	
015	University Regulator	Lake Washington Ship Canal	9/2/14 6:53 PM	9/2/14 7:12 PM	0.32	787,097	0.10	4.20	
015	University Regulator	Lake Washington Ship Canal	10/31/14 9:11 AM	10/31/14 11:19 AM	2.13	2,868,747	1.38	25.53	
015	University Regulator	Lake Washington Ship Canal	11/6/14 8:36 AM	11/6/14 8:59 AM	0.38	787,463	0.66	19.28	
015	University Regulator	Lake Washington Ship Canal	11/23/14 7:36 AM	11/23/14 8:20 AM	0.73	2,282,795	0.48	5.28	
015	University Regulator	Lake Washington Ship Canal	11/28/14 8:55 AM	11/28/14 2:48 PM	5.88	11,592,364	1.28	31.25	
015	University Regulator	Lake Washington Ship Canal	12/23/14 4:25 PM	12/23/14 10:53 PM	6.47	8,645,432	1.13	13.88	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
018	Matthews Park Pump Station Emergency Overflows	Lake Washington			0.00	0			
027a	Denny Way Regulator	Elliott Bay	8/13/14 3:11 AM	8/13/14 3:29 AM	0.29	151,719	0.71	18.37	
028	King Street Regulator	Elliott Bay	1/2/14 9:51 PM	1/2/14 10:24 PM	0.55	263,652	0.53	19.22	
028	King Street Regulator	Elliott Bay	1/8/14 4:47 PM	1/8/14 5:58 PM	1.18	201,636	0.77	41.60	
028	King Street Regulator	Elliott Bay	1/11/14 5:44 AM	1/11/14 2:10 PM	8.43	673,346	0.85	18.27	
028	King Street Regulator	Elliott Bay	1/29/14 1:05 AM	1/29/14 1:36 AM	0.52	64,773	0.57	4.70	
028	King Street Regulator	Elliott Bay	2/11/14 10:44 PM	2/11/14 11:17 PM	0.55	151,534	0.62	7.37	
028	King Street Regulator	Elliott Bay	2/16/14 8:26 PM	2/17/14 1:23 AM	4.95	2,655,723	1.80	37.25	
028	King Street Regulator	Elliott Bay	2/18/14 1:54 PM	2/18/14 2:22 PM	0.47	90,698	2.52	74.23	
028	King Street Regulator	Elliott Bay	3/2/14 5:12 PM	3/3/14 10:20 AM	17.13	1,155,815	0.96	25.20	
028	King Street Regulator	Elliott Bay	3/5/14 2:26 AM	3/6/14 3:17 AM	24.85	4,076,971	2.84	90.58	
028	King Street Regulator	Elliott Bay	3/8/14 2:16 PM	3/10/14 8:04 AM	41.80	3,059,178	1.03	11.40	
028	King Street Regulator	Elliott Bay	3/16/14 7:36 PM	3/16/14 7:51 PM	0.25	50,216	0.80	24.82	
028	King Street Regulator	Elliott Bay	5/3/14 9:18 PM	5/4/14 12:50 AM	3.53	1,156,621	0.98	9.73	
028	King Street Regulator	Elliott Bay	7/23/14 2:21 PM	7/23/14 5:15 PM	2.90	432,529	0.53	12.62	
028	King Street Regulator	Elliott Bay	8/13/14 2:12 AM	8/13/14 6:42 AM	4.50	891,969	0.85	19.25	
028	King Street Regulator	Elliott Bay	9/23/14 11:55 PM	9/24/14 10:51 AM	10.93	212,929	1.28	16.68	
028	King Street Regulator	Elliott Bay	9/26/14 7:23 AM	9/26/14 7:52 AM	0.48	69,803	1.54	61.40	
028	King Street Regulator	Elliott Bay	10/11/14 12:51 PM	10/11/14 12:58 PM	0.12	33,874	0.17	0.23	
028	King Street Regulator	Elliott Bay	10/22/14 11:28 PM	10/22/14 11:36 PM	0.13	58,192	1.15	20.65	
028	King Street Regulator	Elliott Bay	10/31/14 8:29 AM	10/31/14 9:08 AM	0.65	49,177	1.10	23.23	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
028	King Street Regulator	Elliott Bay	11/6/14 8:11 AM	11/6/14 8:18 AM	0.12	26,622	0.54	18.90	
028	King Street Regulator	Elliott Bay	11/28/14 9:14 AM	11/28/14 2:36 PM	5.37	1,467,217	1.26	30.48	
028	King Street Regulator	Elliott Bay	12/23/14 5:17 PM	12/23/14 8:10 PM	2.88	118,628	0.69	5.32	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/11/14 12:19 PM	1/11/14 12:28 PM	0.15	60,530	0.83	17.10	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/29/14 1:02 AM	1/29/14 2:34 AM	1.53	712,645	0.66	5.67	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/10/14 8:19 AM	2/10/14 8:23 AM	0.07	487	0.76	18.07	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/11/14 9:32 PM	2/11/14 11:54 PM	2.37	348,676	0.64	8.07	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/16/14 8:24 PM	2/17/14 2:18 AM	5.90	10,563,718	1.80	37.25	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/18/14 12:58 PM	2/18/14 3:16 PM	2.30	904,007	2.52	74.23	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/2/14 5:19 PM	3/2/14 7:51 PM	2.53	471,696	0.65	10.90	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/5/14 2:35 AM	3/6/14 5:28 AM	26.88	10,645,501	2.89	92.48	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/8/14 2:26 PM	3/8/14 10:54 PM	8.47	2,423,302	1.03	11.40	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/10/14 12:01 AM	3/10/14 5:14 AM	5.22	280,108	0.52	7.73	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/16/14 8:02 PM	3/16/14 10:09 PM	2.12	375,595	0.99	26.80	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	5/3/14 7:29 PM	5/4/14 12:47 AM	5.30	1,686,737	0.98	9.73	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	7/23/14 2:12 PM	7/23/14 4:40 PM	2.47	<100,000	0.53	12.62	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	8/13/14 1:46 AM	8/13/14 5:18 AM	3.53	1,743,320	0.85	19.25	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	9/24/14 12:06 AM	9/24/14 11:22 AM	11.27	1,027,774	1.28	16.68	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/14/14 2:30 AM	10/14/14 2:58 AM	0.47	73,276	0.50	5.82	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/22/14 12:33 PM	10/22/14 4:49 PM	4.27	597,597	0.87	14.00	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/31/14 8:38 AM	10/31/14 12:29 PM	3.85	2,368,728	1.23	24.70	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/21/14 4:46 PM	11/21/14 5:19 PM	0.55	138,666	0.59	11.58	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/28/14 9:18 AM	11/28/14 5:09 PM	7.85	14,127,003	1.35	32.65	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/10/14 3:27 AM	12/10/14 3:44 AM	0.28	68,420	1.08	49.40	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/23/14 5:24 PM	12/24/14 12:55 AM	7.52	4,236,030	1.02	9.87	
030	Lander St Regulator	Elliott Bay	1/2/14 10:26 PM	1/3/14 12:25 AM	1.98	1,355,147	0.41	20.88	
030	Lander St Regulator	Elliott Bay	1/8/14 5:25 PM	1/8/14 6:53 PM	1.47	1,094,411	0.83	41.45	
030	Lander St Regulator	Elliott Bay	1/11/14 5:01 AM	1/11/14 5:21 PM	12.33	6,790,814	1.11	23.08	
030	Lander St Regulator	Elliott Bay	1/29/14 1:04 AM	1/29/14 5:15 AM	4.18	8,882,051	0.70	8.22	
030	Lander St Regulator	Elliott Bay	2/10/14 7:54 AM	2/10/14 9:51 AM	1.95	1,464,343	0.75	19.48	
030	Lander St Regulator	Elliott Bay	2/11/14 8:51 PM	2/12/14 1:19 AM	4.47	7,832,245	0.78	8.17	
030	Lander St Regulator	Elliott Bay	2/15/14 5:23 PM	2/15/14 7:46 PM	2.38	273,707	0.52	7.33	
030	Lander St Regulator	Elliott Bay	2/16/14 8:26 PM	2/17/14 8:45 AM	12.32	30,767,100	2.00	43.98	
030	Lander St Regulator	Elliott Bay	2/18/14 11:18 AM	2/18/14 6:56 PM	7.63	10,857,468	2.59	74.72	
030	Lander St Regulator	Elliott Bay	3/2/14 5:27 PM	3/2/14 6:43 PM	1.27	1,844,522	0.61	9.13	
030	Lander St Regulator	Elliott Bay	3/5/14 2:39 AM	3/6/14 9:07 AM	30.47	15,498,369	3.07	94.35	
030	Lander St Regulator	Elliott Bay	3/8/14 2:35 PM	3/8/14 9:58 PM	7.38	607,431	1.05	11.15	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
030	Lander St Regulator	Elliott Bay	3/10/14 2:37 AM	3/10/14 2:50 AM	0.22	12,416	0.49	5.7	
030	Lander St Regulator	Elliott Bay	3/16/14 6:46 PM	3/17/14 1:49 AM	7.05	11,604,185	0.96	30.37	
030	Lander St Regulator	Elliott Bay	4/17/14 9:04 PM	4/17/14 9:31 PM	0.45	165,412	0.75	40.13	
030	Lander St Regulator	Elliott Bay	5/3/14 7:25 PM	5/4/14 12:53 AM	5.47	16,975,737	1.02	10.03	
030	Lander St Regulator	Elliott Bay	7/23/14 4:17 PM	7/23/14 4:43 PM	0.43	31,500	0.49	8.57	
030	Lander St Regulator	Elliott Bay	8/13/14 1:53 AM	8/13/14 4:33 AM	2.67	4,633,414	0.87	5.95	
030	Lander St Regulator	Elliott Bay	9/24/14 12:05 AM	9/24/14 11:41 AM	11.60	8,701,901	1.48	20.8	
030	Lander St Regulator	Elliott Bay	10/14/14 2:27 AM	10/14/14 3:21 AM	0.90	982,393	0.53	6.20	
030	Lander St Regulator	Elliott Bay	10/22/14 7:45 AM	10/23/14 12:24 AM	16.65	16,509,791	1.41	21.15	
030	Lander St Regulator	Elliott Bay	10/31/14 1:42 AM	10/31/14 2:29 PM	12.78	21,965,538	1.17	27.13	
030	Lander St Regulator	Elliott Bay	11/21/14 3:27 PM	11/21/14 6:12 PM	2.75	6,090,441	0.84	41.38	
030	Lander St Regulator	Elliott Bay	11/23/14 8:42 AM	11/23/14 9:07 AM	0.42	164,158	1.28	79.10	
030	Lander St Regulator	Elliott Bay	11/28/14 9:44 AM	11/28/14 6:35 PM	8.85	39,578,196	1.36	33.27	
030	Lander St Regulator	Elliott Bay	12/10/14 2:39 AM	12/11/14 3:13 PM	36.57	3,630,172	1.86	84.95	
030	Lander St Regulator	Elliott Bay	12/18/14 10:51 PM	12/19/14 12:22 AM	1.52	2,624,154	0.79	51.25	
030	Lander St Regulator	Elliott Bay	12/20/14 12:50 PM	12/20/14 3:49 PM	2.98	4,187,935	1.54	90.95	
030	Lander St Regulator	Elliott Bay	12/23/14 5:28 PM	12/24/14 1:00 AM	7.53	12,921,439	1.08	16.32	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/2/14 8:49 PM	1/2/14 10:25 PM	1.60	1,789,073	0.33	19.38	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/11/14 4:28 AM	1/11/14 12:56 PM	8.47	2,268,524	0.98	19.23	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/29/14 12:47 AM	1/29/14 2:04 AM	1.28	771,671	0.61	5.23	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	2/11/14 10:00 PM	2/11/14 11:26 PM	1.43	848,913	0.74	7.30	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	2/16/14 7:49 PM	2/17/14 4:23 AM	8.57	17,695,105	1.87	39.40	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	2/18/14 10:13 AM	2/18/14 3:09 PM	4.93	2,020,404	2.59	74.72	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/2/14 5:08 PM	3/2/14 5:47 PM	0.65	355,676	0.55	8.15	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/5/14 1:57 AM	3/5/14 11:58 PM	22.02	20,619,625	2.85	85.92	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/8/14 2:27 PM	3/10/14 3:25 AM	36.97	4,583,148	1.08	13.23	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/16/14 7:19 PM	3/16/14 10:41 PM	3.37	2,723,425	0.93	26.60	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/29/14 8:28 AM	3/29/14 8:52 AM	0.40	140,676	0.69	26.82	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	4/17/14 7:29 PM	4/17/14 7:49 PM	0.33	153,005	0.75	40.13	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	5/3/14 5:35 PM	5/4/14 12:01 AM	6.43	1,909,342	1.02	10.03	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	7/23/14 6:49 AM	7/23/14 12:40 PM	5.85	507,704	0.35	5.4	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	8/13/14 12:23 AM	8/13/14 2:56 AM	2.55	906,499	0.67	4.43	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	9/24/14 12:08 AM	9/24/14 8:42 AM	8.57	204,075	1.27	18.82	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/11/14 1:12 PM	10/11/14 1:20 PM	0.13	16,410	0.22	8.82	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/14/14 1:39 AM	10/14/14 1:50 AM	0.18	12,921	0.45	5.23	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/22/14 6:18 AM	10/23/14 12:06 AM	17.80	598,572	1.41	21.15	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/31/14 8:26 AM	10/31/14 11:31 AM	3.08	2,966,396	1.16	25.92	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/6/14 8:29 AM	11/6/14 8:46 AM	0.28	99,795	0.54	19.27	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/21/14 5:20 PM	11/21/14 5:21 PM	0.02	109	0.82	40.5	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/23/14 7:21 AM	11/23/14 8:18 AM	0.95	1,108,650	1.28	79.1	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/28/14 8:50 AM	11/28/14 5:30 PM	8.67	10,010,273	1.36	33.27	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	12/23/14 4:00 PM	12/24/14 1:03 AM	9.05	5,978,011	1.08	16.32	
031b	Hanford #1 (Bayview S.)	Duwamish River via Diagonal Storm Drain	2/16/14 9:50 PM	2/16/14 10:05 PM	0.25	10,172	1.51	34.23	
031b	Hanford #1 (Bayview S.)	Duwamish River via Diagonal Storm Drain	3/5/14 2:50 AM	3/5/14 6:05 AM	3.25	184,670	2.41	68.57	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	1/2/14 9:50 PM	1/2/14 9:55 PM	0.08	6,288	0.31	19.17	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	1/11/14 12:05 PM	1/11/14 12:30 PM	0.42	472,467	0.98	19.23	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	2/16/14 8:25 PM	2/16/14 11:00 PM	2.58	376,734	1.68	35.12	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	3/5/14 2:20 AM	3/5/14 6:00 AM	3.67	1,369,277	2.40	68.45	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	3/8/14 2:40 PM	3/8/14 2:45 PM	0.08	8,062	0.45	4.05	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	3/16/14 7:30 PM	3/16/14 7:35 PM	0.08	145	0.72	24.37	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	7/23/14 6:45 AM	7/23/14 12:20 PM	5.58	57,388	0.31	5.10	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	9/2/14 7:00 PM	9/2/14 7:20 PM	0.33	190,861	0.40	0.13	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	10/11/14 12:50 PM	10/11/14 12:55 PM	0.08	80,069	0.09	8.67	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	10/22/14 11:25 PM	10/22/14 11:30 PM	0.08	4,371	1.39	20.80	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	10/31/14 8:25 AM	10/31/14 8:45 AM	0.33	14,267	1.00	23.15	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/6/14 8:10 AM	11/6/14 8:15 AM	0.08	8,998	0.50	18.72	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/23/14 7:10 AM	11/23/14 7:35 AM	0.42	42,004	1.26	78.92	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/28/14 9:40 AM	11/28/14 9:55 AM	0.25	21,820	0.77	25.87	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	12/23/14 3:40 PM	12/23/14 4:10 PM	0.50	74,641	0.24	7.48	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/2/14 10:27 PM	1/3/14 1:03 AM	2.60	5,606,376	0.41	20.88	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/8/14 5:25 PM	1/8/14 7:05 PM	1.67	1,685,870	0.83	41.45	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/11/14 5:04 AM	1/11/14 6:46 PM	13.70	12,277,544	1.11	23.08	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/29/14 1:04 AM	1/29/14 6:54 AM	5.83	6,545,089	0.73	9.20	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/10/14 7:54 AM	2/10/14 10:41 AM	2.78	5,703,133	0.75	19.48	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/11/14 8:51 PM	2/12/14 2:41 AM	5.83	7,444,532	0.79	10.22	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/15/14 5:24 PM	2/18/14 7:57 PM	74.55	36,806,521	2.59	74.72	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/2/14 5:40 PM	3/3/14 10:04 AM	16.40	4,537,655	0.99	24.17	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/5/14 2:28 AM	3/6/14 10:33 AM	32.08	23,506,391	3.07	94.35	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/8/14 2:30 PM	3/10/14 8:20 AM	41.83	34,029,865	1.08	13.23	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/16/14 6:39 PM	3/17/14 3:07 AM	8.47	15,082,897	0.96	30.37	
032	Hanford #2 Regulator	Duwamish River - East Waterway	4/17/14 9:14 PM	4/17/14 10:31 PM	1.28	669,950	0.75	40.13	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
032	Hanford #2 Regulator	Duwamish River - East Waterway	5/3/14 7:26 PM	5/4/14 4:04 AM	8.63	10,979,861	1.07	13.70	
032	Hanford #2 Regulator	Duwamish River - East Waterway	7/23/14 4:06 PM	7/23/14 4:55 PM	0.82	418,012	0.49	8.57	
032	Hanford #2 Regulator	Duwamish River - East Waterway	8/13/14 1:53 AM	8/13/14 6:06 AM	4.22	14,775,333	0.9	7.02	
032	Hanford #2 Regulator	Duwamish River - East Waterway	9/24/14 12:05 AM	9/24/14 12:42 PM	12.62	24,288,507	1.48	20.8	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/14/14 2:26 AM	10/14/14 4:50 AM	2.40	3,832,099	0.54	7.75	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/22/14 7:43 AM	10/23/14 2:04 AM	18.35	26,797,345	1.41	21.15	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/31/14 1:39 AM	10/31/14 4:20 PM	14.68	18,306,666	1.17	27.13	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/21/14 3:51 PM	11/21/14 7:47 PM	3.93	5,547,771	0.85	41.92	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/23/14 8:40 AM	11/23/14 10:58 AM	2.30	3,250,566	1.31	81.42	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/28/14 9:53 AM	11/28/14 11:16 PM	13.38	30,095,437	1.43	38.50	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/9/14 4:09 AM	12/11/14 4:02 PM	59.88	13,385,446	1.86	84.95	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/18/14 10:51 PM	12/19/14 1:52 AM	3.02	4,636,814	0.83	52.82	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/20/14 11:41 AM	12/20/14 5:21 PM	5.67	3,886,049	1.57	92.05	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/23/14 5:29 PM	12/24/14 3:27 PM	21.97	69,164,098	1.13	19.47	
033	Rainier Ave. Pump Station	Lake Washington			0.00	0			
034	East Duwamish	Duwamish River			0.00	0			
035	West Duwamish	Duwamish River			0.00	0			
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/11/14 5:41 AM	1/11/14 4:21 PM	10.67	161,946	1.11	23.08	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/11/14 9:21 PM	2/12/14 12:57 AM	3.60	1,413,947	0.78	8.17	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/16/14 8:34 PM	2/17/14 11:08 AM	14.57	8,920,107	2.00	43.98	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/18/14 11:23 AM	2/18/14 4:41 PM	5.30	2,381,421	2.59	74.72	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/2/14 5:51 PM	3/2/14 7:40 PM	1.82	184,212	0.68	10.05	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/5/14 2:32 AM	3/6/14 9:32 AM	31.00	26,337,592	3.07	94.35	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/8/14 2:21 PM	3/10/14 8:04 AM	41.72	17,413,063	1.08	13.23	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/16/14 7:49 PM	3/17/14 12:10 AM	4.35	2,999,333	0.93	26.60	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	5/3/14 7:51 PM	5/4/14 12:44 AM	4.88	1,747,100	1.02	10.03	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	10/31/14 9:29 AM	10/31/14 12:20 PM	2.85	1,084,346	1.17	27.13	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/28/14 9:36 AM	11/28/14 4:43 PM	7.12	4,604,355	1.35	32.57	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/23/14 5:46 PM	12/24/14 3:07 AM	9.35	3,696,281	1.11	17.77	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	7/23/14 7:16 AM	7/23/14 7:17 AM	0.03	5,921	0.08	0.08	
038	Terminal 115 Overflow	Duwamish River			0.00	0			
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/2/14 9:38 PM	1/2/14 10:42 PM	1.07	466,790	0.41	28.43	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/11/14 4:35 AM	1/11/14 2:20 PM	9.75	1,289,265	0.81	20.88	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/29/14 12:47 AM	1/29/14 2:32 AM	1.75	403,630	0.69	5.90	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/10/14 7:19 AM	2/10/14 7:48 AM	0.48	10,300	0.55	21.20	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/11/14 9:19 PM	2/11/14 11:48 PM	2.48	949,096	0.74	8.17	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/16/14 7:50 PM	2/17/14 4:13 AM	8.38	14,365,105	2.02	40.65	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/18/14 10:31 AM	2/18/14 3:20 PM	4.82	1,157,699	2.88	75.83	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/2/14 5:33 PM	3/3/14 9:13 AM	15.67	84,180	1.02	26.45	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/5/14 2:10 AM	3/5/14 8:34 PM	18.40	13,211,672	2.85	85.77	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/8/14 2:34 PM	3/8/14 10:55 PM	8.35	2,507,302	1.16	11.55	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/10/14 2:53 AM	3/10/14 3:46 AM	0.88	65,365	0.43	6.40	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/16/14 7:42 PM	3/16/14 10:56 PM	3.23	1,898,645	1.12	26.82	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/29/14 8:42 AM	3/29/14 9:24 AM	0.70	174,454	1.12	98.13	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	4/17/14 7:30 PM	4/17/14 8:15 PM	0.75	1,541,552	1.06	42.10	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	5/3/14 6:03 PM	5/4/14 12:58 AM	6.92	2,906,931	1.13	9.90	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	8/13/14 12:39 AM	8/13/14 4:29 AM	3.83	1,220,294	0.88	29.18	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/2/14 9:58 PM	9/2/14 10:32 PM	0.57	200,650	0.21	0.50	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/24/14 12:01 AM	9/24/14 10:40 AM	10.65	478,718	1.40	20.95	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/14/14 1:01 AM	10/14/14 2:56 AM	1.92	318,222	0.59	14.82	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/22/14 6:12 AM	10/22/14 9:30 PM	15.30	872,406	1.34	18.27	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/30/14 2:03 PM	10/31/14 11:25 AM	21.37	1,801,113	1.86	83.48	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/23/14 7:26 AM	11/23/14 8:26 AM	1.00	2,147,451	1.09	52.30	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/28/14 9:35 AM	11/28/14 3:08 PM	5.55	14,883,748	1.11	32.48	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/10/14 1:59 AM	12/10/14 2:49 AM	0.83	86,136	1.15	65.37	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/18/14 11:21 PM	12/18/14 11:46 PM	0.42	8,859	0.72	43.57	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/23/14 4:39 PM	12/24/14 1:03 AM	8.40	4,097,989	1.03	16.32	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
040	8th Ave South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River			0.00	0			
041	Brandon Street Regulator	Duwamish River	1/2/14 10:19 PM	1/2/14 10:32 PM	0.22	2,574	0.33	19.38	
041	Brandon Street Regulator	Duwamish River	1/11/14 4:34 AM	1/11/14 12:45 PM	8.18	112,831	0.98	19.23	
041	Brandon Street Regulator	Duwamish River	2/11/14 10:50 PM	2/12/14 12:32 AM	1.70	442,450	0.78	8.17	
041	Brandon Street Regulator	Duwamish River	2/16/14 8:30 PM	2/17/14 4:01 AM	7.52	6,378,060	1.87	39.40	
041	Brandon Street Regulator	Duwamish River	2/18/14 1:23 PM	2/18/14 5:12 PM	3.82	968,333	2.59	74.72	
041	Brandon Street Regulator	Duwamish River	3/5/14 2:26 AM	3/5/14 10:15 PM	19.82	11,040,540	2.80	82.57	
041	Brandon Street Regulator	Duwamish River	3/8/14 3:33 PM	3/8/14 11:54 PM	8.35	3,555,384	1.08	13.23	
041	Brandon Street Regulator	Duwamish River	3/16/14 8:15 PM	3/17/14 12:04 AM	3.82	1,160,409	0.93	26.60	
041	Brandon Street Regulator	Duwamish River	5/3/14 9:25 PM	5/4/14 1:33 AM	4.13	3,309,923	1.05	11.77	
041	Brandon Street Regulator	Duwamish River	8/13/14 1:39 AM	8/13/14 4:52 AM	3.22	900,037	0.89	6.37	
041	Brandon Street Regulator	Duwamish River	10/14/14 2:32 AM	10/14/14 2:40 AM	0.14	29	0.52	6.02	
041	Brandon Street Regulator	Duwamish River	10/22/14 6:16 AM	10/22/14 6:21 AM	0.08	121	0.34	3.72	
041	Brandon Street Regulator	Duwamish River	10/31/14 4:01 AM	10/31/14 1:10 PM	9.15	3,841,669	1.17	27.13	
041	Brandon Street Regulator	Duwamish River	11/23/14 7:27 AM	11/23/14 7:48 AM	0.35	25,197	1.28	79.1	
041	Brandon Street Regulator	Duwamish River	11/28/14 9:35 AM	11/28/14 4:44 PM	7.15	11,308,634	1.35	32.57	
041	Brandon Street Regulator	Duwamish River	12/23/14 5:00 PM	12/24/14 2:07 AM	9.12	5,054,409	1.10	17.02	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	2/16/14 9:16 PM	2/17/14 2:10 AM	4.90	588,911	1.92	37.93	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	3/5/14 2:49 AM	3/5/14 10:01 AM	7.20	882,632	2.52	74.92	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	11/28/14 9:40 AM	11/28/14 1:58 PM	4.30	265,934	1.08	29.95	
043	East Marginal Pump Station	Duwamish River			0.00	0			
044a	Norfolk local drainage	Duwamish River			0.00	0			
045	Henderson Pump Station	Lake Washington			0.00	0			
048a	North Beach Pump Station (wet well)	Puget Sound	1/8/14 4:13 PM	1/8/14 4:35 PM	0.37	22,582	0.72	40.48	
048a	North Beach Pump Station (wet well)	Puget Sound	1/11/14 11:46 AM	1/11/14 3:12 PM	3.45	43,660	1.07	19.37	
048a	North Beach Pump Station (wet well)	Puget Sound	1/29/14 12:49 AM	1/29/14 12:18 PM	11.49	63,179	0.91	15.51	
048a	North Beach Pump Station (wet well)	Puget Sound	2/10/14 7:07 AM	2/10/14 7:12 AM	0.08	498	0.60	18.54	
048a	North Beach Pump Station (wet well)	Puget Sound	2/11/14 9:09 PM	2/11/14 10:57 PM	1.80	4,121	1.25	58.49	
048a	North Beach Pump Station (wet well)	Puget Sound	2/16/14 6:12 PM	2/17/14 12:51 AM	6.64	356,571	1.48	36.52	
048a	North Beach Pump Station (wet well)	Puget Sound	2/18/14 10:10 AM	2/18/14 11:31 AM	1.34	50,146	0.31	4.77	
048a	North Beach Pump Station (wet well)	Puget Sound	3/2/14 5:12 PM	3/3/14 7:56 AM	14.73	92,589	1.16	41.79	
048a	North Beach Pump Station (wet well)	Puget Sound	3/5/14 1:54 AM	3/6/14 7:27 AM	29.56	307,345	3.32	113.02	
048a	North Beach Pump Station (wet well)	Puget Sound	3/8/14 12:40 PM	3/8/14 9:42 PM	9.04	99,308	0.96	10.54	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
048a	North Beach Pump Station (wet well)	Puget Sound	3/10/14 1:07 PM	3/10/14 1:43 PM	0.61	16,371	0.60	16.45	
048a	North Beach Pump Station (wet well)	Puget Sound	3/16/14 8:13 AM	3/16/14 9:38 PM	13.42	37,732	1.11	27.81	
048a	North Beach Pump Station (wet well)	Puget Sound	3/29/14 7:44 AM	3/29/14 8:38 AM	0.90	38,513	0.65	26.63	
048a	North Beach Pump Station (wet well)	Puget Sound	4/17/14 9:51 PM	4/17/14 9:58 PM	0.12	1,389	0.43	67.13	
048a	North Beach Pump Station (wet well)	Puget Sound	5/3/14 9:33 PM	5/4/14 4:15 PM	18.70	38,004	1.12	33.58	
048a	North Beach Pump Station (wet well)	Puget Sound	7/23/14 11:48 AM	7/23/14 12:18 PM	0.49	16,364	0.42	7.79	
048a	North Beach Pump Station (wet well)	Puget Sound	8/13/14 12:53 AM	8/13/14 2:53 AM	1.99	4,341	0.67	3.54	
048a	North Beach Pump Station (wet well)	Puget Sound	9/2/14 6:22 PM	9/2/14 6:35 PM	0.23	15,535	0.55	6.38	
048a	North Beach Pump Station (wet well)	Puget Sound	9/23/14 9:32 PM	9/24/14 8:09 AM	10.62	25,010	1.20	19.15	
048a	North Beach Pump Station (wet well)	Puget Sound	10/14/14 12:44 AM	10/14/14 1:28 AM	0.72	2,272	0.40	18.09	
048a	North Beach Pump Station (wet well)	Puget Sound	10/22/14 6:19 AM	10/22/14 8:48 PM	14.47	369	1.24	19.48	
048a	North Beach Pump Station (wet well)	Puget Sound	10/28/14 10:37 AM	10/28/14 10:41 AM	0.06	57	0.54	10.82	
048a	North Beach Pump Station (wet well)	Puget Sound	10/30/14 7:37 PM	10/31/14 10:40 AM	15.05	120,162	1.46	25.19	
048a	North Beach Pump Station (wet well)	Puget Sound	11/6/14 7:59 AM	11/6/14 8:41 AM	0.70	137,634	0.68	19.00	
048a	North Beach Pump Station (wet well)	Puget Sound	11/23/14 6:43 AM	11/23/14 7:56 AM	1.22	104,182	0.45	5.35	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
048a	North Beach Pump Station (wet well)	Puget Sound	11/28/14 8:08 AM	11/28/14 2:11 PM	6.05	133,695	1.15	14.40	
048a	North Beach Pump Station (wet well)	Puget Sound	12/8/14 8:47 PM	12/11/14 1:44 PM	64.94	100,212	1.96	83.91	
048a	North Beach Pump Station (wet well)	Puget Sound	12/19/14 6:44 AM	12/20/14 6:53 AM	24.15	5,344	1.00	74.45	
048a	North Beach Pump Station (wet well)	Puget Sound	12/23/14 3:05 PM	12/23/14 8:05 PM	4.99	33,541	0.79	5.15	
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/8/14 4:15 PM	1/8/14 4:20 PM	0.08	52,850	0.50	36.22	
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/11/14 11:55 AM	1/11/14 12:30 PM	0.58	44,159	0.86	16.62	
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/29/14 11:55 AM	1/29/14 12:15 PM	0.33	45,986	0.90	15.38	
048b	North Beach Pump Station (inlet structure)	Puget Sound	2/16/14 7:20 PM	2/16/14 10:55 PM	3.58	724,531	1.40	34.92	
048b	North Beach Pump Station (inlet structure)	Puget Sound	3/2/14 6:15 PM	3/2/14 7:00 PM	0.75	40,023	0.85	28.88	
048b	North Beach Pump Station (inlet structure)	Puget Sound	3/5/14 2:35 AM	3/5/14 6:05 AM	3.50	331,337	2.61	87.83	
048b	North Beach Pump Station (inlet structure)	Puget Sound	3/8/14 2:35 PM	3/8/14 2:45 PM	0.17	38,721	0.47	3.62	
048b	North Beach Pump Station (inlet structure)	Puget Sound	9/2/14 6:25 PM	9/2/14 6:30 PM	0.08	7,410	0.55	6.38	
048b	North Beach Pump Station (inlet structure)	Puget Sound	10/30/14 7:40 PM	10/31/14 8:55 AM	13.25	1,812	1.10	22.45	
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/6/14 8:00 AM	11/6/14 8:15 AM	0.25	33,563	0.66	18.75	
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/23/14 6:50 AM	11/23/14 7:40 AM	0.83	16,056	0.44	5.23	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/28/14 8:10 AM	11/28/14 8:45 AM	0.58	9,056	0.48	9.03	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/9/14 11:05 AM	12/10/14 5:40 PM	30.58	3,542	1.63	63.71	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/23/14 3:05 PM	12/23/14 3:10 PM	0.08	1,271	0.12	0.27	
049	30th Avenue NE Pump Station	Lake Washington	2/16/14 9:00 PM	2/17/14 12:35 AM	3.58	70,624	1.58	34.23	
049	30th Avenue NE Pump Station	Lake Washington	3/5/14 2:55 AM	3/5/14 6:30 AM	3.58	217,221	2.67	88.62	
052	53rd Avenue SW Pump Station	Puget Sound			0.00	0			
054	63rd Avenue SW Pump Station	Puget Sound	2/16/14 10:51 PM	2/17/14 12:24 AM	1.55	479,691	1.82	36.40	
054	63rd Avenue SW Pump Station	Puget Sound	3/5/14 5:24 AM	3/5/14 6:10 AM	0.77	1,232,931	2.41	68.57	
055	SW Alaska Street Overflow	Puget Sound			0.00	0			
056	Murray Street Pump Station	Puget Sound	1/11/14 4:35 AM	1/11/14 12:28 PM	7.88	1,550,695	0.97	19.18	SSO
056	Murray Street Pump Station	Puget Sound	3/5/14 2:46 AM	3/5/14 3:00 AM	0.23	58,402	1.95	65.48	
056	Murray Street Pump Station	Puget Sound	10/25/14 9:40 PM	10/25/14 11:00 PM	1.33	~200,000			SSO
057	Barton Street Pump Station	Puget Sound	2/16/14 9:32 PM	2/16/14 10:37 PM	1.08	53,117	1.43	34.94	
057	Barton Street Pump Station	Puget Sound	3/5/14 2:10 AM	3/5/14 7:23 PM	17.22	681,820	3.09	101.76	
057	Barton Street Pump Station	Puget Sound	3/10/14 5:04 PM	3/10/14 5:07 PM	0.05	10,083	0.78	20.22	
057	Barton Street Pump Station	Puget Sound	4/17/14 7:19 PM	4/17/14 7:37 PM	0.30	145,745	0.89	39.58	
057	Barton Street Pump Station	Puget Sound	5/3/14 5:23 PM	5/3/14 6:46 PM	1.38	7,040	0.53	5.18	
057	Barton Street Pump Station	Puget Sound	7/23/14 7:13 AM	7/23/14 7:15 AM	0.03	708	0.17	4.19	
057	Barton Street Pump Station	Puget Sound	9/23/14 11:48 PM	9/23/14 11:49 PM	0.02	104	0.69	32.96	

Out-fall #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)	Note if DWO or SSO
057	Barton Street Pump Station	Puget Sound	10/14/14 12:29 AM	10/14/14 12:30 AM	0.02	98	0.30	3.82	
057	Barton Street Pump Station	Puget Sound	10/22/14 6:02 AM	10/22/14 6:16 AM	0.23	10,680	0.44	4.67	
057	Barton Street Pump Station	Puget Sound	11/6/14 8:08 AM	11/6/14 8:09 AM	0.02	53	0.36	12.62	
057	Barton Street Pump Station	Puget Sound	11/28/14 9:42 AM	11/28/14 9:59 AM	0.28	14,680	0.70	34.72	
Total Volume (does not include any DWO volumes)						**1,140,454,618**	**gallons**		

Appendix B
Treated CSO Events

January–December 2014

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Event Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)
001	West Point Wastewater Treatment Plant	Puget Sound	1/2/14 10:31 PM	1/2/14 11:40 PM	1.25	2,440,000	0.33	20.53
001	West Point Wastewater Treatment Plant	Puget Sound	1/8/14 4:51 PM	1/8/14 7:13 PM	1.55	1,200,000	0.73	41.40
001	West Point Wastewater Treatment Plant	Puget Sound	1/11/14 4:58 AM	1/11/14 6:16 PM	7.78	25,800,000	1.09	20.17
001	West Point Wastewater Treatment Plant	Puget Sound	1/29/14 12:54 AM	1/29/14 3:57 AM	2.35	3,740,000	0.74	6.08
001	West Point Wastewater Treatment Plant	Puget Sound	2/10/14 8:32 AM	2/10/14 10:19 AM	2.75	6,500,000	0.70	21.08
001	West Point Wastewater Treatment Plant	Puget Sound	2/11/14 11:17 AM	2/12/14 1:32 AM	4.70	15,940,000	1.32	60.32
001	West Point Wastewater Treatment Plant	Puget Sound	2/15/14 3:44 PM	2/17/14 4:11 AM	12.20	42,796,000	1.49	37.42
001	West Point Wastewater Treatment Plant	Puget Sound	2/18/14 11:15 AM	2/18/14 4:47 PM	5.96	21,790,000	0.45	8.65
001	West Point Wastewater Treatment Plant	Puget Sound	3/2/14 3:26 PM	3/3/14 11:47 AM	9.33	29,440,000	1.23	44.12
001	West Point Wastewater Treatment Plant	Puget Sound	3/5/14 2:46 AM	3/6/14 9:27 AM	23.50	78,620,000	3.33	113.97
001	West Point Wastewater Treatment Plant	Puget Sound	3/8/14 1:47 PM	3/10/14 4:11 PM	18.45	55,970,000	0.99	12.50
001	West Point Wastewater Treatment Plant	Puget Sound	3/16/14 9:06 AM	3/17/14 12:31 AM	7.54	20,510,000	0.60	27.82
001	West Point Wastewater Treatment Plant	Puget Sound	5/3/14 9:27 PM	5/4/14 2:31 AM	5.01	60,200,000	1.11	19.85

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Event Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)
001	West Point Wastewater Treatment Plant	Puget Sound	9/2/14 9:40 PM	9/2/14 10:21 PM	0.68	4,410,000	0.78	9.93
001	West Point Wastewater Treatment Plant	Puget Sound	9/23/14 9:40 PM	9/24/14 12:08 PM	6.70	20,220,000	0.78	21.65
001	West Point Wastewater Treatment Plant	Puget Sound	10/14/14 2:13 AM	10/14/14 4:12 AM	1.98	2,630,000	1.36	19.03
001	West Point Wastewater Treatment Plant	Puget Sound	10/22/14 12:15 PM	10/22/14 11:10 PM	10.07	27,720,000	0.49	21.78
001	West Point Wastewater Treatment Plant	Puget Sound	10/28/14 10:43 AM	10/28/14 5:17 PM	1.57	2,220,000	1.25	13.73
001	West Point Wastewater Treatment Plant	Puget Sound	10/31/14 1:32 AM	10/31/14 2:09 PM	13.30	22,640,000	0.61	25.20
001	West Point Wastewater Treatment Plant	Puget Sound	11/23/14 9:11 AM	11/23/14 10:28 AM	1.28	2,490,000	1.46	5.77
001	West Point Wastewater Treatment Plant	Puget Sound	11/28/14 9:18 AM	11/28/14 7:50 PM	10.53	38,810,000	0.46	20.02
001	West Point Wastewater Treatment Plant	Puget Sound	12/8/14 9:16 PM	12/8/14 10:13 PM	0.90	1,750,000	1.30	20.32
001	West Point Wastewater Treatment Plant	Puget Sound	12/10/14 2:23 AM	12/11/14 4:41 PM	7.62	20,480,000	0.45	85.20
001	West Point Wastewater Treatment Plant	Puget Sound	12/20/14 1:20 PM	12/20/14 2:41 PM	1.16	3,240,000	1.98	81.88
001	West Point Wastewater Treatment Plant	Puget Sound	12/23/14 4:58 PM	12/24/14 4:07 AM	10.52	48,860,000	1.27	12.38
051b	Alki CSO Treatment Facility Outfall	Puget Sound	1/11/2014 4:02 PM	1/11/2014 6:06 PM	2.08	490,000	1.11	23.08
051b	Alki CSO Treatment Facility Outfall	Puget Sound	2/16/2014 10:35 PM	2/17/2014 10:14 AM	11.63	11,300,000	2.04	43.98
051b	Alki CSO Treatment Facility Outfall	Puget Sound	3/5/14 4:00 AM	3/6/14 10:29 AM	23.52	26,270,000	1.94	94.35
051b	Alki CSO Treatment Facility Outfall	Puget Sound	3/8/14 6:58 PM	3/10/14 4:40 PM	25.67	17,130,000	1.73	24.01

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Event Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)
051b	Alki CSO Treatment Facility Outfall	Puget Sound	11/28/14 11:08 AM	11/28/14 8:17 PM	9.17	10,500,000	1.45	35.62
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/23/14 10:58 PM	12/24/14 4:54 AM	5.95	5,680,000	1.13	19.47
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	2/16/14 8:39 PM	2/17/14 3:05 PM	17.4	1,870,000	1.56	43.73
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	3/5/14 3:50 AM	3/6/14 4:39 PM	33.52	5,180,000	3.33	113.97
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	3/8/2014 17:18	3/9/2014 6:13	9.15	1,000,000	0.99	12.5
027b	Elliott West CSO Treatment Facility	Puget Sound	1/11/14 5:16 PM	1/11/14 2:54 PM	2.4	2,420,000	1.32	21.28
027b	Elliott West CSO Treatment Facility	Puget Sound	2/17/14 3:20 AM	2/16/14 9:43 PM	5.08	14,170,000	1.74	67.1
027b	Elliott West CSO Treatment Facility	Puget Sound	2/18/14 3:27 PM	2/18/14 4:06 PM	0.67	450,000	0.53	7.1
027b	Elliott West CSO Treatment Facility	Puget Sound	3/5/14 3:42 AM	3/6/14 11:00 AM	20.7	28,180,000	3.94	115.4
027b	Elliott West CSO Treatment Facility	Puget Sound	3/8/14 5:58 PM	3/8/14 11:42 PM	4.1	7,140,000	1.04	11.4
027b	Elliott West CSO Treatment Facility	Puget Sound	5/3/14 10:30 PM	5/4/14 12:34 AM	2.1	5,800,000	0.93	10.25
027b	Elliott West CSO Treatment Facility	Puget Sound	7/23/14 2:45 PM	7/23/14 5:53 PM	3.2	10,290,000	0.48	9.4
027b	Elliott West CSO Treatment Facility	Puget Sound	8/13/14 3:20 AM	8/13/14 9:40 AM	6.35	19,690,000	0.78	20.9
027b	Elliott West CSO Treatment Facility	Puget Sound	10/22/14 3:30 PM	10/22/14 9:25 PM	3.8	4,730,000	1.19	19
027b	Elliott West CSO Treatment Facility	Puget Sound	10/31/14 9:18 AM	10/31/14 12:03 PM	2.8	6,640,000	1.22	25.8
027b	Elliott West CSO Treatment Facility	Puget Sound	11/28/14 10:37 AM	11/28/14 6:30 PM	7.4	19,880,000	1.31	33.4

Appendix B. Treated CSO Events

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/ Time	Event Ending Date/ Time	Event Duration (hours)	Volume (gallons)	Precipi-tation (inches)	Storm Duration (hours)
027b	Elliott West CSO Treatment Facility	Puget Sound	12/23/14 7:05 PM	12/24/14 12:54 AM	5.8	12,520,000	1.14	9.7
044b	Henderson/MLK CSO Treatment Facility Outfall	Duwamish Waterway	2/27/14 3:04 AM	2/27/14 8:30 AM	5.46	800,000	1.76	44.76
044b	Henderson/MLK CSO Treatment Facility Outfall	Duwamish Waterway	3/6/14 1:15 AM	3/6/14 12:05 AM	1.17	110,000	2.91	96.69
		Total Volume				**775.8 MG**		

Appendix C
Alki CSO Treatment Plant
Annual Report

January–December 2014

Executive Summary

This 2014 annual report summarizes performance of King County's Alki CSO Treatment Plant. The Alki CSO Treatment Plant came online for CSO treatment in 1998; it operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

A total of 41.8 inches of rain fell in calendar year 2014, as measured at the rain gauge located at the Chelan Pump Station, the nearest gauge to the Alki CSO Treatment Plant. The annual rainfall recorded at Sea-Tac was 48.5 inches for 2014 compared to the historical annual average measured at Sea-Tac of 37.27 inches (20 year average).

There were eight filling events and six discharge events during 2014. The Alki CSO Treatment Plant received 90.7 MG and discharged 71.4 MG. The annual average TSS removal was 51 percent for the year (after removing the March 4-6, 2014 event as the "one untreated discharge per year") thereby meeting the NPDES permit limit of 50 percent for annual removal. The TSS removal for all discharge events during the year was 48.7 percent. Alki CSO Treatment Plant met its annual average SS limit with the average measured as 0.22 milliliters/ liter/hour (mL/L/hr) and the NPDES permit limit being 0.3 mL/L/hr. The Alki CSO Treatment Plant exceeded its fecal coliform limit for one month, which is a maximum monthly geomean limit, and its total residual chlorine limit (TRC) on one day, which is a maximum daily average limit. The Alki CSO Treatment Plant also fell below an instantaneous minimum pH of less than 6.0 on two discharge days – January 11 and February 16, 2014. The performance of the Alki CSO Treatment Plant for 2014 has been summarized below in Table C-1.

Table C-1. Alki CSO Treatment Plant Permit Performance in 2014

Parameter	Performance	Permit Conditions
Discharge events (number)	6	29 [a]
Discharge volume (MG)	71.4	108 [a]
Annual average SS (mL/L/hr)	0.22	0.3
Event maximum SS (mL/L/hr)	0.70	1.9
Annual average TSS removal- including all discharge events (%)	48.7	50
Annual average TSS removal- without March 4-6, 2014 event (%)	51	50
Instantaneous minimum effluent pH	3.4	6.0
Instantaneous maximum effluent pH	7.4	9.0
Total residual chlorine, maximum of daily averages (µg/L)	510	234
Monthly fecal coliform geomean (#/100 mL)	1,200	400

[a] Compliance assessed over a 5-year average.

Suspended and Settleable Solids

The annual TSS removal was calculated to be 51 percent, after excluding the March 4-6, 2014 event; therefore, Alki CSO Treatment Plant met its annual average TSS removal permit level of 50 percent. However, the annual removal was calculated to be 48.7 percent if all discharge event data were included. The annual average SS was 0.22 mL/L/hr.; therefore, meeting the annual average NPDES permit level of 0.3 mL/L/hr. The 2014 event maximum for SS was measured to be 0.70 mL/L/hr which occurred on November 28, 2014. There were no exceedances for the six discharge events. Alki CSO Treatment Plant met the SS event maximum for each discharge events during 2014 with the NPDES permit limit of 1.9 mL/L/hr for the event maximum.

Fecal Coliform Bacteria

The maximum value for the fecal coliform geomean was 1,200 counts/100 mL occurring in February; thereby not meeting the NPDES permit's monthly limit for geomean of 400 counts/100 mL. The fecal coliform geomean only exceeded the NPDES permit limit one out of the five months with discharges. The annual average of monthly fecal coliform geomean was 337 counts. During the February 16-17, 2014 discharge, the initial fecal coliform sample taken within the first hour of the discharge was very high (2,400 counts/100 mL). It appears that the initial hypochlorite dose was low – as indicated by a very low pre-dechlor residual. This first fecal coliform grab sample caused the geomean to exceed the 400/100 mL. The second fecal coliform sample (4-8 hour grab) had no detected fecal coliform.

Total Residual Chlorine

Maximum of daily average effluent TRC during the 2014 reporting year was 510 µg/L. This maximum daily average TRC occurred on the February 16-17, 2014 event, only once out of the 11 discharge days. The TRC exceedance was a result of short-circuiting. As flows increased, the third pump came on-line at the 63rd Ave. pump station, which directs flows to Alki CSO Treatment Plant. When this occurred, there was an increase in the hydraulic grade line within the plant, as the plant adjusted to increase the rate of gravity flow through the outfall. This momentary increase resulted in flooding over the wall of the effluent channel, thereby bypassing the sodium bisulfite (SBS) application point for dechlorination prior to discharge. The annual TRC average was 120 µg/L.

Instantaneous Minimum and Maximum Effluent pH

The daily instantaneous minimum and maximum pH during the 2014 reporting period was 3.4 and 7.4, respectively. Therefore, Alki CSO Treatment Plant did not meet its NPDES permit limit for daily instantaneous pH minimum equal to or greater than 6.0; however, the maximum pH equal to or less than 9.0 was met. The instantaneous minimum pH below 6.0 occurred 2 days out of 11 discharge days. The first exceedance of the minimum pH less than 6.0 occurred on the January 11, 2014 discharge event. During this event, dechlorination started automatically, but the sodium bisulfite (SBS) pumps were inadvertently in the "manual / local" mode at a 100 percent output. The high dose resulted in an initial discharge of effluent below a pH of 6.0. The second incident occurred on the February 16, 2014 discharge event. The pH exceedance occurred during the first 10 minutes of the discharge. The data trend for this event indicated that the pH dropped below 6.0 before the treated flows crested the effluent weir. Then, as the discharge continued, the pH trend was increasing back to a stable level. This

may have been caused by the sample pump picking up the SBS from the previous feed pump exercise by staff. As part of station check list and preventive maintenance (PM), the feed pumps are exercised monthly. In the near future, the .

Operation and Maintenance

There have been major upgrades made to Alki CSO Treatment Plant by King County staff. Highlights of O&M activities at Alki during 2014 include:

- Conducted annual CSO refresher training for the operators in October 2014.
- Shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals.
- Completed improvements to the influent sampling system by relocation of the influent sample intake and sampling equipment to the division channel.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continue quarterly testing the treatment chemicals strength concentration (sodium hypochlorite and sodium bisulfite solutions) and make necessary changes in either of the feed programs or replacement of chemicals.
- Implemented a preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.
- Installed new on-line amperometric chlorine residual analyzers for the inflow (intermediate chlorine residual), final effluent and pre-dechlorination chlorine residual monitoring and reporting.
- Completion of the Alki CSO Treatment Plant dechlorination system improvement project.

Dechlorination System Improvements Project

The project to improve the dechlorination system started construction in 2013 and was completed by the end of summer 2014. The project comprised of increasing the storage capacity of SBS from the old storage volume of 1,000 gallons to 3,000 gallons and installing new, larger capacity feed pumps and a chemical feed flow meter. In addition, the project included two SBS feed control "modes" – a flow-paced feed mode based on Alki CSO Treatment Plant flow and automatic pre-dechlor chlorine residual mode in which SBS feed is controlled by both plant flow and pre-dechlor chlorine residual. Operators will be able to select between these feed control modes based on the operating circumstance.

Near Future Operation

With Alki CSO Treatment Plant, as with other CSO treatment plants, opportunities to operate and then to optimize have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. WTD staff will continue to investigate, make any necessary adjustments in the O&M of Alki CSO Treatment Plant. In addition, WTD staff responding to Alki CSO Treatment Plant will:

- Continue to evaluate and make any necessary adjustments to the dechlorination system as part of the Dechlorination System Improvement Project.
- Continue with the project for new Variable Frequency Drives for the 63rd Street pumps.
- Follow up with a project work request was initiated to evaluate feed pump capacity size and make recommendations on the replacement of the current oversized hypochlorite feed pumps.

Table C-2. Alki CSO Plant Annual Event Data Summary

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
January	11	1	2.89	1	0.49	1,784	337		0.30	0.30	80	20	4.4/6.4
	Instant. Min/Max pH												4.4/6.4
	Event/Daily Max									0.3		20	
	Monthly Total/Avg./Geomean	1	2.89	1	0.49	1,784	337	81.1%			80		
February	16	1a	12.63	1a	9.74	5,477	3,241		0.10		1,200	140	3.4/6.3
	17	1b	1.56	1b	1.54	677	234		0.10	0.10	^ED	510	6.2/6.5
	Instant. Min/Max pH												3.4/6.5
	Event/Daily Max									0.1		510	
	Monthly Total/Avg./Geomean	1	14.19	1	11.28	6,154	3,475	43.5%			1200		
March	4	1a	8.81	1a	6.75	6,025	1,846		0.10		1	146	6.0/6.1
	5	1b	19.41	1b	17.95	2,914	2,764		0.10		1	223	6.1/6.5
	6	1c	1.57	1c	1.57	1,270	1,270		0.80	0.33	1	110	6.4/6.4
	8	2a	13.62	2a	11.69	4,316	2,902		0.10		1	140	6.2/6.4
	9	2b	6.53	2b	4.56	1,470	814		0.10		1	10	6.2/6.4
	10	2c	0.88	2c	0.88	198	136		0.10	0.10	1,300	10	6.2/6.3
	Instant. Min/Max pH												6.0/6.5
	Event/Daily Max									0.3		223	
	Monthly Total/Avg./Geomean	2	50.82	2	43.40	16,194	9,732	39.9%			3		
April	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.00	ND	ND						ND		
May	3	1	0.86	ND	ND	409	39						

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	1	0.86	ND	ND	409	39	90.3%			ND		
June	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.00	ND	ND						ND		
July	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND						ND		
August	No Inflow/No Discharge.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND						ND		
September	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND	ND	ND				ND		
October	31	1	0.6	ND	ND	1,027	137						
	Instant. Min/Max pH												ND

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	1	0.56	ND	ND	1,027	137	86.7%			ND		
November	28	1	12.9	1	10.5	7,514	3,491		0.4	0.4	NR	10	6.0/6.75
	Instant. Min/Max pH												6.0/6.75
	Event/Daily Max									0.4		10	
	Monthly Total/Avg./Geomean	1	12.87	1	10.5	7,514	3,491	53.5%			NR		
December	23	1	8.48	1	5.68	3,183	1,391		0.1	0.10	65	0	6.0/8.6
	Instant. Min/Max pH												6.0/8.6
	Event/Daily Max									0.1		0	
	Monthly Total/Avg./Geomean	1	8.48	1	5.7	3,183	1,391	56.3%			65		
	Total	8	90.67	6	71.39	36,264	18,602						
	Instantaneous pH Min/Max												3.4/7.4
	Max (GEM, SS, TRC)									0.70	1200	510	
	Annual Average							48.7%		0.22	337	120	

Notes:
^ED= End of discharge; fecal coliform samples were collected for 0-3 and 4-8 hour grabs then discharge ended before next grab sample was required.
ND= No discharge.
NR= Not Reported due to lab error.
NS- No sample collected.
Red= NPDES permit exceedance.

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total TSS Inf. (lbs)	Total TSS Eff. (lbs)	Annual Avg. TSS Removal (%)	Max of Event Avg. SS (mL/L/lhr)	Annual Avg. SS (mL/L/hr)	Max Monthly Geomean Fecal Coliform Eff. (#/100 mL)	Annual Avg. of Monthly Geomean Fecal Coliform Eff. (#/100 ml)	Max of Daily Avg. TCR Eff. (ug/L)	Instantaneous Min/Max pH
Includes all events	90.7	71.4	36,264	18,602	48.7%	0.70	0.22	1,200	337	510	3.4/7.4

Appendix D
Carkeek CSO Treatment Plant
Annual Report

January–December 2014

Executive Summary

This report is the twenty-first annual report summarizing the performance of Carkeek CSO Treatment Plant. The Carkeek CSO Treatment Plant began to operate as a CSO treatment facility on November 1, 1994. The Carkeek CSO Treatment Plant operates under the NPDES permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1.

2014 was characterized by above average annual rainfall. The total rainfall for the reporting period was 38.96 inches, as measured by the Ballard Station rain gauge. Sea-Tac recorded 48.5 inches for 2014 compared to the historical annual average measured at Sea-Tac of 37.27 inches (20 year average).

Carkeek CSO Treatment Plant performed well in 2014. The annual average solids removal, as measured by the TSS percent removal, was 68.3 percent. There was a single NPDES permit violation for the year - an instantaneous pH of less than 6.0 on one discharge day. All remaining parameters met NPDES permit limits.

Performance in 2014

In 2014, there were 17 inflow events into the Carkeek CSO Treatment Plant and 3 resulted in discharges to Puget Sound out of the outfall. The total inflow and discharge volumes for the reporting period were 10.9 MG and 8.1 MG, respectively. There was one NPDES permit exceedance during 2014 and that was for an instantaneous minimum pH less than 6.0. The 2014 performance of the Carkeek CSO Treatment Plant is summarized below in Table D-1.

Table D-1. Carkeek CSO Permit Performance in 2014

Parameter	Performance	Permit Conditions
Discharge events (number)	3	10 [a]
Discharge volume (MG)	8.05	46 [a]
Annual average SS (mL/L/hr)	0.10	0.3
Event maximum SS (mL/L/hr)	0.10	1.9
Annual average TSS removal- including all discharge events (%)	68.3	50
Instantaneous minimum effluent pH	5.9	6.0
Instantaneous maximum effluent pH	6.8	9.0
Total residual chlorine, maximum of daily averages (µg/L)	30	490

Parameter	Performance	Permit Conditions
Monthly fecal coliform geomean (#/100 mL)	22	400

[a] Compliance assessed over a 5-year average.

Suspended and Settleable Solids

TSS removal averaged 68.3 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent. The annual SS for the year averaged 0.10 ml/L/hr and the event maximum SS was 0.5 ml/L/hr, thereby meeting the Permit limits annual average SS and event maximum SS. None of the three discharge events exceeded the NPDES permit limits.

Fecal Coliform Bacteria

The maximum monthly geomean during the 2014 reporting period occurred in February and was 22 counts/100 ml, thereby meeting the monthly NPDES permit limit of 400 counts/100ml. The annual average of the monthly geomean was 28 counts/100ml. None of the two months with discharges exceeded the NPDES permit limit.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2014 reporting period was 5.9 and 6.8, respectively, thereby not meeting the NPDES permit limits for instantaneous minimum pH equal to or greater than 6.0. However, the maximum pH never exceeded NPDES permit limit of equal to or less than 9.0. The instantaneous pH fell below 6.0 on February 16, 2014, resulting in a pH exceedance during the discharge. This occurred at the very beginning of the discharge, when the pH fell below 6.0 for one minute. At the beginning of the event, the disinfection (sodium hypochlorite) dosage was initially too high, which then required a higher dechlorination dosage. Since the dechlorination process, using SBS, consumes alkalinity, the higher SBS dosage, required for dechlorination, caused the pH to initially drop below 6.0. Only one of the six days with discharge had an exceedance of the pH NPDES permit limit.

Total Residual Chlorine

The maximum daily average effluent TRC during the 2014 reporting year was 30 µg/L, thereby meeting the NPDES permit limit of 490 µg/L. None of the six days with discharges exceeded the NPDES permit limit.

Operation and Maintenance

In 2014, WTD staff modified the SBS feed system to include valves and fittings to be able to recirculate SBS back to the storage tank and flush the feed line. These modifications allow staff to drain and flush the SBS feed line after each treatment event, to prevent a build-up of SBS crystals in the feed line. A new shipment of SBS was received in March 2014. Sodium hypochlorite was replaced with fresh hypochlorite in September 2014. Annual CSO refresher training for the off-site operations staff was provided in September 2014.

The project to improve flow measurements at Carkeek CSO Treatment Plant was completed in fall 2014. New flow meters to better measure inflow and effluent flows were installed along with a modified final effluent weir. A project to purchase and install new hypochlorite feed pumps was also completed in fall 2014. The hypochlorite pump replacement project included two new gear metering pumps, a set of variable frequency drives for the feed pumps, and a hypochlorite feed flow meter.

Near Future Operation

During Carkeek CSO Treatment Plant's 20 years of operation, opportunities to operate and then to optimize have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. Given the "normal" challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons.

Table D-2. Carkeek Annual Plant Performance 2014

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
January	8	1	0.06	ND	ND	296.8	23.4		ND	ND	ND	ND	
	11	2	0.20	ND	ND	212.4	23.1		ND	ND	ND	ND	ND
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	2	0.26	0	ND	509	47	90.9%			ND		
February	16	1a	2.19	1a	1.87	1,057.4	425.6		0.10		500	10	5.9/6.7
	17	1b	0.00	1b	0.00	1.9	0.8		0.10	0.1	1	10	6.2/6.2
	18	2	0.19	ND	ND	108.4	19.8						
	Instant. Min/Max pH												5.9/6.7
	Event/Daily Max									0.10		10	
	Monthly Total/Avg./Geomean	2	2.4	1	1.9	1,168	446	61.8%			22		
March	2	1	0.19	ND	ND	145.7	17.8		ND		ND	ND	ND
	4	2a	1.44	1a	1.02	780.6	309.1		0.10		1	10	6.3/6.7
	5	2b	2.70	1b	2.93	1,081.3	643.2		0.10		1	30	6.4/6.8
	6	2c	1.09	1c	1.23	427.7	240.0		0.10	0.1	1	10	6.7/6.8
	8	3	1.50	2	1.00	740.1	304.9		0.10	0.1	1	10	6.6/6.7
	10	4	0.04	ND	ND	23.3	3.5		ND		ND	ND	ND
	16	5	0.33	ND	ND	1,115.3	108.2		ND		ND	ND	ND
	29	6	0.01	ND	ND	23.1	1.3		ND		ND	ND	ND
	Instant. Min/Max pH												6.3/6.8
	Event/Daily Max									0.10		30	
	Monthly Total/Avg./Geomean	6	7.31	2	6.18	4,337	1,628	62.5%			1.0		
April	No Inflow/No Discharge												

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.00	ND	ND						ND		
May	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.00	ND	ND						ND		
June	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.00	ND	ND						ND		
July	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND						ND		
August	No Inflow/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND						ND		
September	No Inflow/No Discharge												

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	0	0.0	ND	ND						ND		
October	31	1	0.35	ND	ND	516.6	68.9		ND				
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	1	0.35	ND	ND	517	69	86.7%			ND		
November	6	1	0.04	ND	ND	71.1	3.7		ND				
	23	2	0.10	ND	ND	59.4	2.2		ND				
	28	3	0.21	ND	ND	276.7	30.7		ND				
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	3	0.35	ND	ND	407	37	91.0%			ND		
December	9	1	0.02	ND	ND	4.6	0.44		ND				
	11	2	0.07	ND	ND	28.4	3.65		ND				
	23	3	0.16	ND	ND	98.0	10.12		ND				
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./Geomean	3	0.25	ND	ND	131	14.2	89.2%			ND		
Total		17	10.91	3	8.05	7,069	2,240						
Instantaneous pH Min/Max													5.9/6.8
Max (GEM, SS, TRC)										0.10	22	30	
Annual Average								68.3%		0.10	12	13	

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total TSS Inf. (lbs)	Total TSS Eff. (lbs)	Annual Avg. TSS Removal (%)	Max of Event Avg. SS (mL/L/lhr)	Annual Avg. SS (mL/L/hr)	Max Monthly Geomean Fecal Coliform Eff. (#/100 mL)	Annual Avg. of Monthly Geomean Fecal Coliform Eff. (#/100 ml)	Max of Daily Avg. TCR Eff. (ug/L)	Instantaneous Min/Max pH
Includes all events	10.9	8.05	7,069	2,240	68.3%	0.10	0.10	22	12	30	5.9/6.8

Notes:
ND= No discharge.
Red= NPDES permit exceedance.

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Appendix E
Mercer/Elliott West CSO Treatment Plant
Annual Report

January–December 2014

Executive Summary

This document constitutes the tenth annual report of the Mercer/Elliott West CSO Treatment Facility (EWCSO). It summarizes the performance and operation of EWCSO during January−December 2014.

EWCSO began operating in July 2005. The facility operates under the permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1.

Total rainfall recorded in 2014 was 55.3 inches as measured at the Denny Way rain gauge station which is located at 3165 Alaskan Way in Seattle. The reported 2014 annual rainfall measured at Seattle-Tacoma International Airport (Sea-Tac) was 48.5 inches. The historical annual average measured at Sea-Tac is 37.27 inches (20 year average).

There were 34 inflow events and 12 discharge events in 2014. EWCSO received a total of 467.9 MG of CSO flow out of which 131.9 MG was treated and discharged through the EWCSO outfall at the Denny Regulator Station located in Myrtle Edwards Park. Nearly 30 percent of the total discharged CSO volume occurred in March 2014.

Performance in 2014

Table E-1 summarizes EWCSO NPDES permit performance in 2014.

Table E-1. Mercer/Elliott West CSO Permit Performance in 2014

Parameter	Performance	Permit Conditions
Discharge events (number)	12	N/A
Discharge volume (MG)	131.9	N/A
Annual average SS (mL/L/hr)	1.93	0.3
Event maximum SS (mL/L/hr)	5.50	1.9
Annual average TSS removal- including all discharge events (%)	60.9	50
Instantaneous minimum effluent pH	5.9	6.0
Instantaneous maximum effluent pH	8.1	9.0
Total residual chlorine, maximum of daily averages (µg/L)	1,198	104
Monthly fecal coliform geomean (#/100 mL)	47	400

Suspended and Settleable Solids

Including the data from all the discharge events in 2014, the annual TSS removal was calculated to be 60.9 percent. Therefore, EWCSO met the NPDES permit limit of 50 percent.

Meeting the SS NPDES permit limits continues to be a challenge at EWCSO. The annual SS concentration for the 2014 discharge events averaged 1.93 mL/L/hr, exceeding the NPDES permit limit of 0.3 mL/L/hr. The event maximum during 2014 was 5.5 mL/L/hr. On 4 (of a total of 12) separate discharge events, the event maximum SS was measured greater than the event maximum limit of 1.9 mL/L/hr. With the ongoing challenges of meeting the NPDES permit limits, King County has started a project with consultant engineers to help determine the issues with solids removal and SS compliance. An extensive sampling plan has been established to monitor flows and solids entering the Mercer Tunnel and EWCSO pipeline (wet well inputs from the west flows). It is anticipated that the solids sampling and monitoring project will start in fall of 2015.

Fecal Coliform Bacteria

In 2014, EWCSO met the fecal coliform NPDES permit limit. The maximum monthly geomean for fecal coliform bacteria was calculated as 47 counts/100 mL. The annual average of monthly geomeans was 13.4 counts/100 mL. In 2014, the highest fecal coliform count was 1,750 counts/100 mL, and it occurred during the March 8, 2014 discharge.

Total Residual Chlorine

During 2014, there were 7 discharge days out of 16 that exceeded the maximum daily average TRC NPDES permit level of 104 µg/ml. These events occurred on February 18 (140 µg/L), July 23 (332 µg/L), August 12 and 13 (1,079 and 201 µg/L, respectively), October 31 (1,198 µg/L), November 28 (697 µg/L) and December 23 (414 µg/L) (see Table E-2). The TRC exceedances may have been caused by inadequate SBS mixing and the continuous adjustments made to the SBS feed in direct response to the minimum pH excursions. The SBS feed program has been assessed and adjusted by staff throughout the year. It is possible that SBS under feeding contributed to the TRC exceedances. In addition, from examining event data trends, it is speculated that the SBS mixing may be inadequate. The current SBS mixing is accomplished by using carrier water and two induction mixers located at the base of the 96-inch diameter effluent pipe. It is thought that the mixing efficiencies may have been impacted by insufficient carrier water flow when water service to the Denny Station was inadequate. The Denny station is where dechlorination occurs for EWCSO. The water service was repaired and upgraded to provide higher flows and pressures at Denny in July 2014. A continuous minimum water flow and higher water pressure is needed, not only for the source of SBS carrier water, but also for back-flushing sample pumps and lines. WTD staff is continuing to fine-tune the chemical feed controls as well as the monitoring equipment - the online chlorine analyzers and pH meter.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum and maximum effluent pH in 2014 was measured as 5.86 and 8.10, respectively. There were a total of 16 discharge days in 2014, and 6 of those discharge days had the instantaneous minimum effluent pH measured below the NPDES permit level of 6.0, while there were no events exceeding the maximum pH limit of 9.0. Typically, a drop in the effluent pH during discharge and treatment indicates a potential overdosing of SBS or overdosing of sodium hypochlorite. The dechlorination reaction with SBS consumes alkalinity, and a high pre-dechlor chlorine residual requires additional SBS feed, which in turn results in the consumption of alkalinity. In response to these incidents of depressed effluent pH values, staff has been fine-tuning the SBS feed control program, reducing SBS feed, and reducing hypochlorite feed; however, these actions did not prevent all exceedances in 2014. Further analysis of the data trends of discharge events is on-going.

Staff has continued to gather additional information for the investigation into these pH exceedances. This includes the additional sampling and testing that started in 2012, which was for supplemental alkalinity sampling of the wet well, pump discharge channel, pre-dechlor sample and final effluent sample streams. The alkalinities of the inflow and final effluents have been determined to be in the range 12 to 40 mg/L as $CaCO_3$. These very low alkalinity values are contributing to the pH challenges. Staff have also been using a portable pH meter as an independent measurement throughout the treatment process, starting with the flows entering the wet well at EWCSO, then proceeding to measure the pH of the pump discharge flows, pre-dechlorination, and final effluent. The inflows have a pH measurement around 7.0. From the data collection during discharges, it has been suggested that the low alkalinity values measured from the inflows at EWCSO, along with high hypochlorite feed, were causing the dechlorination reaction to consume alkalinity and to cause the pH depression in the final effluent. WTD staff will continue to respond to EWCSO discharges in order to fine-tune the chlorination and dechlorination controls. Additional troubleshooting and the implementation of system improvements will occur in 2015.

Operation and Maintenance

Highlights of O&M activities at EWCSO during 2014:

- Conducted annual CSO refresher training for the operators in September 2014.
- Continued to provide an on-site response team in anticipation of a treatment and discharge event, and during the event. The members of the multi-disciplinary response team work together to troubleshoot and fine-tune the chlorination-dechlorination feed controls, sampling, and process control.
- Completed the repair and upgrade of City of Seattle water service to the Denny Station in July 2014.
- Replaced both dewatering pumps at EWCSO with new pumps; the old pumps were severely damaged as a result of the sea-water intrusion when the marine flap gate failed in late 2013.
- Replaced one of the two SBS flash mixers in July 2014.
- Continued the automated Mercer Tunnel flushing program at the East Portal flushing gate as an attempt to flush and capture the solids settled in the Mercer Tunnel.
- Continue to monitor the effectiveness of the automated Mercer Tunnel flushing by taking

additional samples from the return flows and running laboratory solids analyses on the those samples.

- Continued to run the dewatering pumps during discharges in order to remove additional solids, which takes advantage of the turbulence and re-suspension of solids in the wet well caused by the larger main pumps and increases the amount of solids in the return flows to the West Point Treatment Plant.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Implemented additional procedures to the post-discharge event routines including equipment testing, cleaning and de-ragging within the dechlor and final effluent vaults/structures. Equipment includes both pre-dechlor and final effluent sample pumps and sample intakes and SBS mixers.
- Continued to exercise the chemical feed pumps on a monthly basis as a preventive maintenance measure.

Chlorination-Dechlorination System Improvements Project

2014 marks the third year of operation for the chlorination-dechlorination system controls, part of the Chlorination-Dechlorination System Improvement Project. This project was completed in November 2011. The response team was tasked with troubleshooting and fine-tuning the feed controls, and they responded to each treatment and discharge event when the wet well was filling, prior to the start of the main discharge pumps. It was decided to switch to Mode 3 for hypochlorite feed. Use of Mode 3 allows for better hypochlorite feed control which should reduce the potential of over feeding of hypochlorite, and therefore, could also reduce the over feeding of SBS. To fine-tune the new system, station performance was evaluated during the operations debriefing held after each discharge event. This continuous improvement process is ongoing.

Instrumentation and Sampling Equipment Relocation and Improvements Project

King County started a project to relocate and improve sample delivery and to relocate the process instrumentation and monitoring equipment at Denny station (the location of EWCSO dechlorination and final effluent monitoring). The instrumentation and sampling equipment will be relocated to a separate dedicated room out of the SBS day tank room. The current configuration of having sensitive instrumentation (chlorine residual analyzers, pH and dissolved oxygen meters and samplers) is incompatible with SBS day tank chemical storage. In addition to relocating the instrumentation, the pre-dechlorination and final effluent amperometric chlorine residual analyzers will be replaced with newer models that will be programed to enter a “sleep-mode” during non-discharge days, thus, saving instrument wear, reduce city water and reagent chemical use. As part of this project, the current sample lines and copper flushing water lines will be replaced with non-metal materials that will meet the standards for priority pollutant sampling and eliminate the non-compatible material contamination of samples. The design phase of this project started in early 2015, and it is projected to be completed by fall of 2017.

Near Future Operation

During EWSCO's nine years of operation, opportunities to operate and then to optimize have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. Given the complexity of EWSCO's design and operation and the "normal" challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons. WTD staff will continue to fine-tune the chlorination-dechlorination controls and assess and improve the facility performance using these additional tools.

In addition, WTD staff responding to EWSCO will:

- Continue to investigate and correct the cause(s) of the instantaneous minimum pH exceedance.
- Continue to implement the response team to EWCSO as the wet well fills and in anticipation of a discharge.
- Continue evaluation and fine-tuning of the new chlorination and dechlorination controls.
- Evaluate the recently completed Final Effluent Monitoring Improvement Project.
    - In early 2014, maintenance staff modified the back-up sampling pump so that the sample flow can be directed to either final effluent or pre-dechlorination sample stilling well in order to sustain on-line instrumentation process and compliance monitoring as opposed to manually sampling and recording by responding operators.
- Implement a new project to relocate instrumentation and sampling equipment into a separate room out of the SBS day tank room.
- Implement a manual CSO pumping strategy. Responding operators would manually control the main pumps speed to reduce pumping rates and to minimize the sudden ramping of flows through the treatment process. This strategy will be further evaluated and if possible incorporate into the pumping control logic.
- Implement copper and dissolved oxygen monitoring of EWCSO flows.
- Implement additional laboratory solids analyses on all flows sampled at EWCSO as part of the monitoring of the automated Mercer Tunnel flushing program.

Table E-2. Elliott West Annual Plant Performance 2014

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
January	2	1a	6.71	#ND	ND	4,855	262						
	3	1b	1.83	ND	ND	306	14						
	7	2a	0.09	ND	ND	268	12						
	8	2b	4.69	ND	ND	3,160	249						
	9	2c	0.84	ND	ND	542	14						
	10	2d	0.57	ND	ND	41,311	1,252						
	11	2e	13.19	1	2.42	17,230	4,753		0.10	0.1	1	*NM	NM
	12	2f	1.57	ND	ND	1,811	107						
	28	3a	0.89	ND	ND	943	31						
	29	3b	8.21	ND	ND	3,594	1,019						
	30	3c	0.65	ND	ND	4,192	195						
	Instant. Min/Max pH												NM
	Event/Daily Max									0.10		*NM	
	Monthly Total/Avg./ Geomean	3	39.26	1	2.42	78,211	7,908	89.9			1.0		
February	10	1a	5.56	ND	ND	4,846	504						
	11	1b	5.19	ND	ND	2,175	174						
	12	1c	1.49	ND	ND	261	43						
	14	2a	0.58	ND	ND	751	69						
	15	2b	2.70	ND	ND	944	197						
	16	2c	16.15	1a	13.83	209,035	60,955		1.40	-	20	50	6.0/8.1
	17	2d	8.00	1b	0.34	8,199	3,443		1.40	1.4	1	0	5.9/6.4
	18	2e	8.57	2	0.45	3,940	727		0.10	0.1	1	140	5.9/7.9
	19	2f	1.63	ND	ND	868	45						
	21	3	0.66	ND	ND	287	9						
	24	4a	5.30	ND	ND	2,029	89						
	25	4b	2.08	ND	ND	1,680	64						

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Instant. Min/Max pH												5.9/8.1
	Event/Daily Max									1.4		140	
	Monthly Total/Avg./ Geomean	4	57.90	2	14.62	235,013	66,319	71.8			2.7		
March	2	1a	12.01	ND	ND	8251	1010						
	3	1b	2.40	ND	ND	4586	712						
	4	1c	15.75	1a	14.37	14938	11198		1.00	-	20	40	6.2/7.6
	5	1d	18.23	1b	12.02	8246	5284		0.10	-	1	40	5.8/7.3
	6	1e	13.53	1c	1.79	5889	2110		0.10	0.40	^ED	0	6.4/6.8
	7	1f	3.32	ND	ND	2643	120						
	8	1g	20.27	2	7.14	18870	8854		5.00	5.00	1750	100	6.2/7.0
	9	1h	6.77	ND	ND	1336	271						
	10	1i	3.78	ND	ND	7352	1095						
	11	1j	0.53	ND	ND	11535	555						
	16	2a	5.98	ND	ND	1045	101						
	17	2b	1.43	ND	ND	452	38						
	18	2c	0.25	ND	ND	535	16						
	25	3	0.23	ND	ND	175	6						
	28	4a	0.19	ND	ND	837	45						
	29	4b	1.57	ND	ND	2982	168						
	Instant. Min/Max pH												5.8/7.3
	Event/Daily Max									5.0		100	
	Monthly Total/Avg./ Geomean	4	106.22	2	35.32	89,672	31,584	64.8			32.7		
April	15	1	3.12	ND	ND	3,563	74						
	17	2	1.40	ND	ND	4,288	298						
	19	3	0.21	ND	ND	521	18						
	Instant. Min/Max pH												ND

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./ Geomean	3	4.72	ND	ND	8,372	390	95.3			ND		
May	3	1a	16.34	1	5.80	16,484	7,360		2.50	2.5	1,300	12	6.0/8.0
	4	1b	3.16	ND	ND	597	62						
	5	1c	0.65	ND	ND	5,285	143						
	8	2	0.55	ND	ND	216	11						
	Instant. Min/Max pH												6.0/8.0
	Event/Daily Max									2.5		12	
	Monthly Total/Avg./ Geomean	2	20.70	1	5.8	22,581	7,576	66.4			&1.26		
June	No Inflows/No Discharge												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./ Geomean	0	0.0	ND	ND	0.00	0.00				ND		
July	23	1a	13.09	1	10.29	37,425	33,831		5.50	5.50	300	332	6.4/7.7
	24	1b	1.95	ND	ND	716	19						
	Instant. Min/Max pH												6.4/7.7
	Event/Daily Max									5.50		332	
	Monthly Total/Avg./ Geomean	1	15.04	1	10.3	38141	33849	11.25			&1.21		
August	12	1a	16.28	1a	16.23	28,000	27,886		2.5		1700	1079	6..1/7.5

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	13	1b	12.44	1b	3.46	27,878	9,973		6.0	4.3	110	201	6.0/6.4
	14	1c	0.53	ND	ND	3,181	102						
	Instant. Min/Max pH												6.0/7.75
	Event/Daily Max									4.3		1079	
	Monthly Total/Avg./ Geomean	1	29.25	1	19.69	59,058	37,960	35.72			&1.5		
September	2	1	1.36	ND	ND	6,569	268						
	23	2a	8.67	ND	ND	6,554	110						
	24	2b	14.00	ND	ND	9,196	643						
	25	2c	0.61	ND	ND	1,228	17						
	26	2d	0.48	ND	ND	939	12						
	29	3	0.85	ND	ND	1,528	21						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg./ Geomean	3	25.97	0	0	26,014	1,072	95.9			ND		
October	11	1	2.38	ND	ND	5,392	110						
	13	2a	6.55	ND	ND	1,371	33						
	14	2b	1.97	ND	ND	492	24						
	15	2c	1.01	ND	ND	338	13						
	19	3a	0.23	ND	ND	180	5						
	20	3b	0.73	ND	ND	845	25						
	21	3c	0.07	ND	ND	38	1						
	22	3d	26.31	1	4.73	25,686	6,208		0.60	0.6	20	61	5.9/7.0
	23	3e	2.74	ND	ND	937	24						
	24	3f	0.44	ND	ND	269	4						
	25	3g	2.37	ND	ND	954	32						
	26	3h	0.62	ND	ND	1,699	44						

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	27	3i	0.07	ND	ND	22	1						
	28	3j	2.41	ND	ND	1,063	41						
	30	4a	2.08	ND	ND	1,974	79						
	31	4b	18.03	2	6.64	11,572	7,494		0.30	0.3	110	1198	5.5/7.7
	Instant. Min/Max pH												5.5/7.7
	Event/Daily Max									0.6		1198	
	Monthly Total/Avg./ Geomean	4	68.00	2	11.37	52,832	14,138	73.2			47		
November	1	1a	0.86	ND	ND	359	6						
	2	1b	0.32	ND	ND	140	4						
	3	1c	0.28	ND	ND	180	6						
	5	2a	1.56	ND	ND	663	19						
	6	2b	5.10	ND	ND	4,269	224						
	21	3a	2.13	ND	ND	2,290	164						
	22	3b	1.02	ND	ND	3,847	122						
	23	3c	5.78	ND	ND	5,116	188						
	24	3d	0.03	ND	ND	21	0						
	25	3e	0.20	ND	ND	150	5						
	27	4a	0.10	ND	ND	4,237	91						
	28	4b	27.78	1	19.88	34,403	19,150		1.75	1.75	%NR	697	5.9/7.6
	29	4c	2.10	ND	ND	1,523	113						
	Instant. Min/Max pH												5.9/7.6
	Event/Daily Max									1.75		697	
	Monthly Total/Avg./ Geomean	4	47.25	1	19.88	57,199	20,094	64.9			%NR		
December	5	1a	0.63	ND	ND	545	18						
	6	1b	0.41	ND	ND	226	9						
	8	2a	1.58	ND	ND	607	39						

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ EWCSO + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
	9	2b	3.89	ND	ND	14,506	1,395						
	10	2c	7.60	ND	ND	2,575	327						
	11	2d	3.88	ND	ND	2,351	302						
	12	2e	0.53	ND	ND	2,026	76						
	18	3a	3.12	ND	ND	1,689	64						
	19	3b	2.07	ND	ND	861	49						
	20	3c	3.11	ND	ND	905	105						
	23	4a	22.92	1	12.52	18,855	12,153		1.30	1.30	20	414	6.0/7.7
	24	4b	3.52	ND	ND	1,563	174						
	25	4c	0.07	ND	ND	45	2						
	27	5	0.21	ND	ND	114	5						
	Instant. Min/Max pH												6.0/7.7
	Event/Daily Max									1.3		414	
	Monthly Total/Avg./ Geomean	5	53.55	1	12.5	46,867	14,717	68.6%			20		
Total		34	467.9	12	131.9	713,961	235,608						
Instantaneous pH Min/Max													5.86/8.10
Max (GEM, SS, TRC)										5.50	47	1198	
Annual Average								60.90		1.93	13.4	291	

Notes:
* NM= Not measured due to the FE sample pump failed
NM= Not measured
%NR= Not reported due to lab error
&Monthly Geomean was calculated with "1's " in non-discharge days.The effluent daily average fecal coliform was 1300 reported in the May 2014 PMR NS- No sample collected.
Red= NPDES permit exceedance

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total TSS Inf. (lbs)	Total TSS Eff. (lbs)	Annual Avg. TSS Removal (%)	Max of Event Avg. SS (mL/L/lhr)	Annual Avg. SS (mL/L/hr)	Max Monthly Geomean Fecal Coliform Eff. (#/100 mL)	Annual Avg. of Monthly Geomean Fecal Coliform Eff. (#/100 ml)	Max of Daily Avg. TCR Eff. (ug/L)	Instantaneous Min/Max pH
Includes all events	467.9	131.9	713,961	235,608	60.90	5.50	1.93	47	13	1198	5.86/8.10

Appendix F
Henderson/MLK CSO Control System
Annual Report

January–December 2014

Executive Summary

This 2014 annual report summarizes the performance of King County's Henderson/MLK CSO treatment facilities. The Henderson/MLK CSO treatment facilities came online in 2005 and operate under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

A total of 39.01 inches of rain fell in 2014 as measured at Henderson Pump Station. Sea-Tac recorded 48.5 inches for 2014 compared to the historical annual average measured at Sea-Tac of 37.27 inches (20 year average).

There were six filling events and two discharge events during 2014. The Henderson/MLK CSO Treatment Plant received a total inflow of 9.10 MG and discharged 0.91 MG of treated water through the Norfolk Outfall to the Duwamish Waterway.

Performance in 2014

The Henderson/MLK CSO treatment facilities operated well in 2014. All NPDES permit performance conditions were met except for maximum daily chlorine limit on March 5. See Table F-1. TSS removal averaged 74 percent. In 2014, a consultant was hired to evaluate and recommend improvements to the Henderson/MLK CSO facility to address the problems that the facility has had in consistently meeting disinfection and dechlorination requirements. In 2015, action will begin on these recommendations.

Table F-1. Henderson/MLK CSO Permit Performance in 2014

Parameter	Performance	Permit Conditions
Discharge events (number)	2	N/A
Discharge volume (MG)	0.91	N/A
Annual average SS (mL/L/hr)	<0.2	0.3
Event maximum SS (mL/L/hr)	0.3	1.9
Annual average TSS removal- including all discharge events (%)	74	50
Instantaneous minimum effluent pH	6.4	6.0
Instantaneous maximum effluent pH	6.7	9.0

Parameter	Performance	Permit Conditions
Total residual chlorine, maximum of daily averages (µg/L)	161	39
Monthly fecal coliform geomean (#/100 mL)	1	400

[a] Compliance assessed over a 5-year average.

Suspended and Settleable Solids

TSS removal averaged 74 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent. The annual SS for the year averaged <0.2 ml/L/hr and the event maximum SS was 0.3 ml/L/hr, thereby meeting the Permit limits annual average SS and event maximum SS.

Fecal Coliform Bacteria

The maximum monthly geomean during the 2014 reporting period was 1 count/100 ml, thereby meeting the monthly NPDES permit limit of 400 counts/100ml. The annual average of the monthly geomean was 1 count/100ml.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2014 reporting period was 6.4 and 6.7, respectively, thereby meeting the NPDES permit limits for instantaneous minimum and maximum pH of 6.0 and 9.0, respectively.

Total Residual Chlorine

The maximum daily average effluent TRC during the 2014 reporting year was 161 µg/L, which is above the NPDES permit limit of 39 µg/L.

Operation and Maintenance

The equipment and facilities of the Henderson/MLK CSO treatment system were fully functioning and available during 2014. Preventive maintenance was performed routinely. Routine O&M activities not directly associated with an event included weekly operator inspections, checklists, equipment and sampler testing, alarm checks, weekly analyzer preventive maintenance and calibrations, quarterly lubrication and preventive maintenance of mechanical equipment, annual training and preparation for winter wet weather operation, post-event cleaning of the CSO facilities, and post-event debriefs and corrective work orders as appropriate. More details are available in the monthly discharge monitoring reports.

Near Future Operation

No major projects are currently in progress, however proposed upgrades include:

- Tunnel level measurement

- Inlet regulator — Installation of a new fine-range bubbler sensor. The new fine-range pressure sensor would be retrofitted into the existing bubbler panel. The existing bubbler sensor would be retained for measuring the full depth of the tunnel and for redundancy. A new small receiver tank would be provided and an air dryer and a pressure regulator would supply instrument air to the existing full range bubbler and the new fine-range bubbler. The existing compressor system would directly feed the existing sampler and would charge the new receiver tank when little or no purge air was being supplied to the sampler. The local programmable logic controller (PLC) would send an alarm for any unacceptable difference in readings between the sensors. The ongoing accuracy of the sensors would be monitored and logged.
- Outlet regulator — Installation of a new fine-range bubbler sensor. The existing sonic level sensor would be retained for measuring the full depth of the tunnel and for redundancy. A new bubbler air panel, compressor, and air receiver to supply air for the bubbler sensor would be installed. The PLC would be set to send an alarm for any unacceptable difference in readings between the sensors. The ongoing accuracy of the sensors would be monitored and logged.

o Weir flow measurement — Reconfiguration of the existing weirs (at both the inlet and outlet regulator) to gradually inclined weirs.

o Chemical dosage control
  - Gas binding—Installation of new automated degassing valve on the sodium hypochlorite and SBS chemical pumps. Strainers to remove crystals and other solids would be installed.
  - SBS dose control— Provide a new chlorine analyzer system upstream of the overflow weir at the outlet regulator. Data from this analyzer would be tied to the PLC and would be used for feed-forward dosing of SBS. The data from the dissolved oxygen analyzer and pH from the compliance sampler would be monitored and logged.
  - Turndown for chemical pumps — Provide flow meters for the SBS and sodium hypochlorite chemical pumps. The flow meter data would be monitored and logged to confirm the chemical feed pumps are pumping correctly and for future reference to evaluate system performance.

o Equipment redundancy — Alarm signals to PLC to indicate if the sodium hypochlorite and/or SBS chemical pumps are not pumping would be provided.

o Effluent on-line residual chlorine monitoring — A solenoid valve would be set to automatically close when the sample pump is turned on and open after the end of overflow events.

Table F-2. Henderson/MLK Annual Plant Performance 2014

Month	Day/ Parameter	Inflow Event (#)	Inflow Volume (MG)	Discharge Event (#)	Discharge Volume (MGD)	Total Inf. TSS (lbs)	Total Eff. TSS Discharged @ Hen/MLK + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Eff. SS Event Max Average (ml/l/hr)	Average Daily Eff. Fecal Coliforms (#/100 ml)	Eff. TRC Daily Average (ug/l)	Daily Min/Max pH
January	No Inflow/No Discharge												
February	16	1a	4.36	1a	0.68	2,618.0	923.0	N/A	0.30	0.30	1	3	6.4/6.7
	17	1b	0.14	1b	0.12	84.0	77.0	N/A	N/A	N/A	N/A	N/A	N/A
	Instant. Min/Max pH												6.4/6.7
	Event/Daily Max									0.30		3	
	Monthly Total/Avg./Geomean	2	4.5	1	0.8	2,702.0	1,000.0	63.0%			1		
March	4	1a	2.99	ND	0.00	1,396.0	101.0		N/A	N/A	N/A	N/A	N/A
	5	1b	0.80	1	0.11	514.0	184.0		<0.1	<0.1	0.00	161	6.6/6.6
	8	2	0.67	ND	0.00	156.0	32.0		N/A	N/A	N/A	N/A	N/A
	16	3	0.14	ND	0.00	58.0	6.0		N/A	N/A	N/A	N/A	N/A
	Instant. Min/Max pH												6.6/6.6
	Event/Daily Max									<0.1		161	
	Monthly Total/Avg./Geomean	4	4.60	1	0.11	2,124.0	323.0	84.8%			0.00		
April	No Inflow/No Discharge												
May	No Inflow/No Discharge												
June	No Inflow/No Discharge												
July	No Inflow/No Discharge												
August	No Inflow/No Discharge												
September	No Inflow/No Discharge												
October	No Inflow/No Discharge												
November	No Inflow/No Discharge												
December	No Inflow/No Discharge												
Total		6	9.10	2	0.91	4,826	1,323						
Instantaneous pH Min/Max													6.6/6.6
Max (GEM, SS, TRC)										0.30	1	161	
Annual Average								73.9%		0.20	1	161	

Notes:
N/A= Not applicable
ND= No discharge
Red= NPDES permit exceedance