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Department of Natural Resources and Parks
Wastewater Treatment Division
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July 31, 2014

Mark Pollins, Director
Water Enforcement Division
Office of Civil Enforcement
U. S. Environmental Proection Agency
1200 Pennsylvania Avenue NW
Mail Code 2243-A
Washington, D.C. 20460

Dear Mr. Pollins:

RE: King County Combined Sewer Overflow (CSO) Control Program Consolidated Annual Consent Decree and NPDES Report

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In accordance with the reporting requirements in Section VIII of the Consent Decree, Civil Action No. 2:13-cv-677, enclosed is King County's second Combined Sewer Overflow (CSO) Control Program Consent Decree Annual Report, dated July 31, 2014. The report addresses the County's CSO control project and compliance activities from the effective date of the consent decree, July 3, 2013, through December 2013.

Under King County's National Pollutant Elimination Discharge System (NPDES) permit WA-002918-1 S18.B.2 and Washington Administrative Code (WAC) 173-245-090(1)(a)-(c), the County also submits a CSO control program annual report to the Washington State Department of Ecology (Ecology). This report documents CSO control program activities for calendar year 2013. Previous reports are available on the County's CSO control program website at: http://www.kingcounty.gov/environment/wastewater/CSO/Library/AnnualReports.aspx.

With the agreement of United States Environmental Protection Agency and Ecology, this report responds to the reporting requirements of the consent decree, the WAC and the NPDES permit in a single document.

King County is committed to meeting all the milestones and actions outlined in the consent decree, and in the WAC and NPDES permit. Compliance with the consent decree and regulations is a top priority for the County's Wastewater Treatment Division (WTD). We are providing ongoing trainings, briefings, and division-wide communication to all WTD staff involved in implementing the consent decree. I am pleased to report that all the projects and plans outlined in the consent decree are on schedule to achieve their critical milestones.

Thank you for your review of the first King County CSO Control Program Consent Decree Annual Report. If you have any questions or would like additional information, please contact me at 206-477-4530, or at pam.elardo@kingcounty.gov.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision, in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Pam Elardo, P.E., Director
Wastewater Treatment Division
King County Department of Natural Resources and Parks

25 July 2014
Date

Enclosure

cc: Robert Grandinetti, NPDES Compliance Officer, Office of Compliance and Enforcement, United States Environmental Protection Agency (EPA), Region 10
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Combined Sewer Overflow Control Program

2013 Annual CSO and Consent Decree Report

July 2014 (Amended September 2014)

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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Contents

1.0 Introduction 5
1.1 King County CSO Locations 6
1.2 CSO Control Plans, Amendments and Updates 6
1.2.1 CSO Control Plans, 1979-2008 7
1.2.2 The 2012 Plan Review and Long-term CSO Control Plan Amendment 10
1.3 EPA Compliance Review and Consent Decree Development 11
1.3.1 Consent Decree Implementation 12
1.4 Ecology Agreed Order 12
1.5 Sediment Sampling and Analysis 12
1.6 Organization of this Report 13
Requirement Crosswalk 13
2.0 Programs to Meet EPA's Nine Minimum Controls 16
2.1 Control 1—Reducing CSOs through Operation and Maintenance 16
2.2 Control 2—Storing CSOs in Collection System 21
2.3 Control 3—Optimizing Pretreatment Program 22
2.4 Control 4—Maximizing Flow to Treatment Plant 25
2.5 Control 5—Preventing Dry-Weather Overflows 26
2.6 Control 6—Controlling Solids and Floatables 27
2.7 Control 7—Preventing Pollution 28
2.8 Control 8—Notifying the Public 30
2.9 Control 9—Monitoring CSO Outfalls 32
3.0 Currently Under Way and Early Action CSO Control Measures 34
3.1 Project Summaries 35
3.2 Program Summaries 46
3.2.1 Sewer System Operational Plan 47
3.2.2 Joint Operations and System Optimization Plan Between City of Seattle and the County 48
4.0 Summary of Rainfall and CSO Events 50
4.1 Annual Rainfall 50
4.2 Unpermitted Overflows 50
4.3 Annual Untreated CSO Events 51
4.4 CSO Treatment 51
4.4.1 West Point CSO-related Bypass 52
4.4.2 Alki CSO Treatment Plant 52

4.4.3 Carkeek CSO Treatment Plant 52
4.4.4 Mercer/Elliott West CSO Treatment and Storage Facilities 53
4.4.5 Henderson/Norfolk CSO Treatment and Storage Facilities 53
5.0 Summary of Consent Decree Violations Since CD Became Effective 55
6.0 Twenty-Year Moving Average of Event Frequencies 56
7.0 Post-Construction Monitoring 59

Appendices 60
Appendix A. Untreated CSO Events, January–December 2012 ..... A-1
Appendix B. Treated CSO Events, January–December 2012 ..... B-1
Appendix C. Alki CSO Treatment Plant Annual Report C-1
Appendix D. Carkeek CSO Treatment Plant Annual Report D-1
Appendix E. Mercer/Elliott West CSO Treatment Plant Annual Report E-1
Appendix F. Henderson/Norfolk CSO Control System Annual Report F-1

Tables

Table 1. Dry-Weather Overflow Events, 2013 50

Table 2. Untreated CSO Events, Averages, and Baselines, 1994–2013 57

Figures

Figure 1. King County CSO Locations 9

Figure 2. Adopted Project Schedule to Complete Program by end of 2030 11

Figure 3. West System Pipeline Storage 23

1.0 Introduction

King County's Wastewater Treatment Division (King County)—responsible to manage the regional wastewater system—prepares annual reports on its combined sewer overflow (CSO) control program and submits them to the Washington State Department of Ecology (Ecology). The annual reports are completed to fulfill requirements under the National Pollutant Discharge Elimination (NPDES) permit for the County's West Point Treatment Plant in Seattle and requirements in WAC 173-245-090.[1]

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 Consent Decree requires submittal of an annual report detailing implementation of the Consent Decree. The first CD report was submitted at the end of the first calendar quarter after the CD effective date, October 3, 2013. With the agreement of EPA and Ecology the two annual reports are now being consolidated into one. This 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. Additionally, compliance with regulations, the NPDES permits and the CD is a top priority for King County. The CD is a new requirement as of 2013. The County is committed to meeting all the milestones and actions outlined in the Consent Decree. To support this King County is providing its staff ongoing trainings, briefings, and division-wide communication on the Consent Decree to ensure everyone works together to achieve these priorities. As a result all the projects and plans outlined in the Consent Decree are on schedule to achieve their critical milestones.

This report documents CSO control program activities and information for 2013 on the following topics:

- Implementation of early action and long-term CSO control plan measures
- CSO overflow volumes and frequency of overflows (including overflow durations and associated rainfall data)
- Information on any CSO-related bypasses as the West Point treatment plant
- Information on any dry weather overflows
- Sewer Systems Operations Plan Implementation

[1] WAC = Washington Administrative Code.

- Development of the Joint Operations and System Optimization Plan Between the City of Seattle and the County
- NPDES Permit compliance for the King County CSO treatment plants.

The annual rainfall for 2013, as an average over local rain gauges, was an average of 24.93 inches, which is quite a bit lower than the long-term Sea-Tac annual average of 37.07 inches. The wettest months were April (4.06 inches) and September (4.48 inches). Hydraulic modeling predicts that King County CSOs will discharge 800 million gallons (MG) of untreated CSO in an average year of rainfall. Conditions in 2013 resulted in 150 untreated events discharging 385.86 MG and treated CSOs totaled 10 events discharging 84 MG.

The following sections provide background on King County's wastewater system and its CSO control program and describe new requirements for the program under the Consent Decree, lodged with the federal court in July 2013.

1.1 King County CSO Locations

King County provides wholesale wastewater conveyance and treatment of flows from 17 cities, 16 local sewer utilities, and one 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 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 1000 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). 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 these 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 review—conditions such as flow patterns, scientific developments, changed regulations, new technologies, and public priorities. Significant change may require adjustment of the CSO Control Plan.

1.2.1 CSO Control Plans, 1979-2008

Metro first formalized CSO control with the development of the *1979 CSO Control Program* (1979 Program). It 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 systemwide 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/Norfolk 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 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 and the control status of its CSOs and overall progress, indicated how the County meets the U.S. Environmental Protection Agency's (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).

Figure 1. King County CSO Locations

The West Point Treatment Plant NPDES permit was renewed July 1, 2009. The renewed permit contained new requirements for the CSO control program. The permit is currently undergoing renewal and has been administratively extended by Ecology until the renewal process has been completed.

1.2.2 The 2012 Plan Review and Long-term CSO Control Plan Amendment

The County's current cycle of review began in 2010 and resulted in King County Executive Dow Constantine submitting his recommended CSO Control Plan to the King County Council for review and approval in June 2012.

In September 2012, the King County Council unanimously approved an amendment to the CSO Control Plan describing nine projects to control 14 CSOs by 2030 for $711 million dollars (2010 dollars). The adopted amendment to the plan was submitted to Ecology November 20, 2012, ahead of the June 2013 application date for the NPDES permit renewal.

The adopted projects emerged from a three-year comprehensive review of the CSO control program. During the review King County evaluated new conditions, opportunities, new science and 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 ones were the most cost effective and cost efficient. The adopted projects reflect community priorities heard during the public review process:

- Completing most projects in the Lower Duwamish River area first to support ongoing regional efforts to clean up the river. Later projects will 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 amendment contains nine projects to control 14 CSOs by the end of 2030. 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/Elliot Bay area. King County and the City of Seattle will 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. 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.

The 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.

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

Figure 2 shows the adopted schedule of projects.

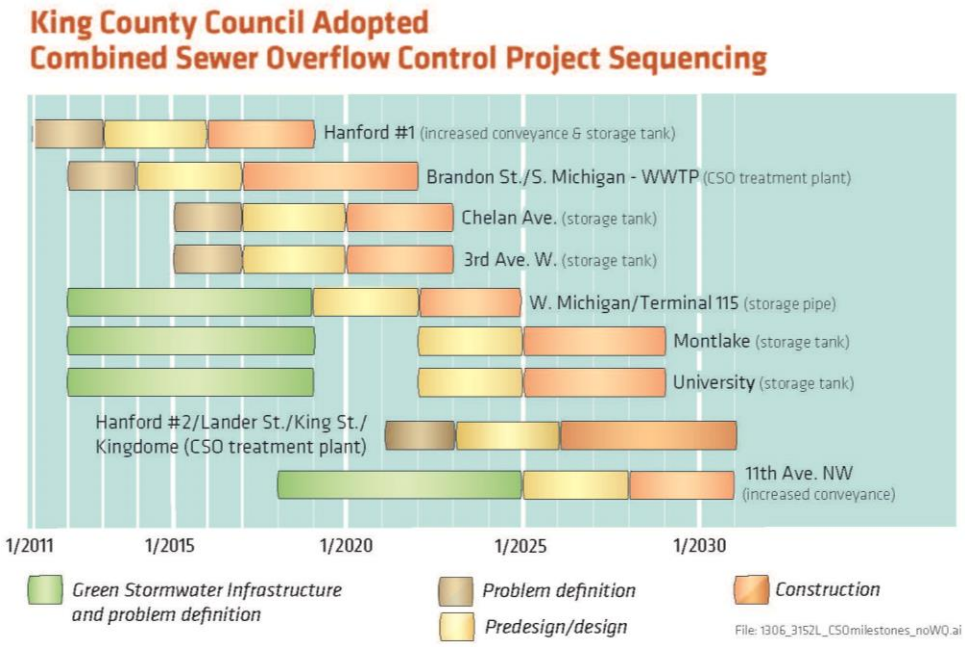


Figure 2. Adopted Project Schedule to Complete Program by end of 2030

1.3 EPA Compliance Review and Consent Decree Development

In January 2008, EPA began a compliance review of the County's wet-weather management programs in relation to the federal CSO control policy. Such reviews were occurring across the country under a strategy set by EPA's Office of Enforcement and Compliance Assurance (OECA). Agencies that manage combined systems are selected to be reviewed based on their size, population served, and system complexity. The City of Seattle's program began a similar review at the same time. EPA and Ecology concluded their review of the King County's CSO Control Plan and King County's Amended 2012 Long-term CSO Control Plan (LTCP) in the fall of 2012, and EPA approved the County's LTCP as meeting federal requirements on March 7, 2013. In parallel with the plan development and to establish enforceable milestones for implementation of King County's CSO Control Plan, the terms of a consent decree (CD) were drafted. The draft CD was submitted to the King County Council in November 2012 for their consideration and was approved. After Council approval, it was approved in early 2013 by the King County Executive and was subsequently lodged with the federal court on April 16, 2013.

The Department of Justice filed a motion to enter the CD with the court. The CD was approved and became effective on July 3, 2013. The requirements of the Consent Decree are now being implemented.

1.3.1 Consent Decree Implementation

The Consent Decree required several plans that are completed or progressing well. These include the following:

- 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 Operational Plan, submitted September 2013. A letter approving the Plan was received from Ecology on May 30, 2014. Some minor revisions have been requested and will be incorporated in the next update.
- Joint Operations and System Optimization Plan with the City of Seattle, due March 1, 2016.
    - Progress Reports submitted December 31, 2013 and again due December 31, 2014.

Project summary sheets for these plans detailing 2013 progress, planned work in 2014, and their schedule of milestones can be found in Section 3 of this report.

1.4 Ecology Agreed Order

In 2011, King County and Ecology entered into an Agreed Order establishing compliance milestones for King County to forward a CSO control plan to the King County Council by September 2012 (completed) and control all CSOs by 2030. The Consent Decree also addresses the control of all CSOs and establishes the enforcement mechanism envisioned in the Agreed Order for meeting the CSO plan. Ecology was a party to the Federal Consent Decree. With the Consent Decree and Agreed Order addressing the same issue, it creates the potential for conflicting requirements. In light of the potential conflict, Ecology rescinded the Agreed Order in August 2013.

1.5 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 in the process of updating that plan. 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 will be used to calibrate and verify model performance. Sediment sampling results of the first round covering the Barton, Chelan, 53rd, Brandon, Montlake, and 3rd Ave W CSO locations were provided to Ecology at the end of 2012. The second set of sampling covering Belvoir, University, Chelan (additional

sampling), Murray, North Beach and S. Magnolia occurred in 2012 (and was provided to Ecology April 2014).

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 review this model to 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.

1.6 Organization of this Report

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

- Section 2—a report on implementation of the Nine Minimum Controls, as defined in the renewed NPDES permit.
- Section 3—status of CSO control projects in progress.
- Section 4—discussion of 2013 rainfall and CSO events.
- Section 5—a table showing the 20-year average frequency of untreated CSO events for each site.
- Section 6—Post-Construction Monitoring
- Appendix A—detailed event-based tables for untreated CSOs in 2013.
- Appendix B—detailed event-based tables for treated CSOs in 2013.
- Appendices C through F—annual reports for the four satellite CSO treatments facilities—Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk.

Requirement Crosswalk

This report meets the requirement of the Consent Decree, Washington Administrative Code and NPDES permit requirements for annual reports. The following crosswalks indicate where information meeting the requirements can be found.

Consent Decree Section	Content	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	(i) 3.1 Project Summaries 3.2.1 Sewer System Operational Plan 3.2.2 Information Sharing/Coordination Program Plan Between County and the City of Seattle (called Joint Operations and

Consent Decree Section	Content	Report Location
	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.	Optimization Plan in the CD Appendix D) 6.0 Post-construction monitoring (ii) Included in sections above, 4.3 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.	4.3 Summary of Consent Decree Violations 2.1 Reducing CSOs Through Operations and Maintenance App. C-F for CSO Treatment Facilities

WAC Section	Content	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 5.0 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 WA-002918-1	Content	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	5.0 Twenty-year Moving Average of Event Frequencies Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B

NPDES Permit WA-002918-1	Content	Report Location
	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.	
S18.H.	Compliance with the NMC 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.	5.0 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.	5.0 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 more quickly 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 2013.

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 staff using King County's SCADA system.[2] 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 collection system staff maintain CSO outfalls, regulator stations, and pump stations. Collection system staff inspect 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 done 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 during 2013

The following improvements were under way during 2013 to improve the solids process which can limit the amount of flow that can be treated.

[2] SCADA = Supervisory Control and Data Acquisition system, which provides monitoring and control capabilities for the treatment plant collection systems.

Screenings Building and Upgrades

Existing 5/8-inch screens are being replaced with 3/8-inch screens. The new screenings handling facilities will accommodate up to 10-times the screened material resulting in better processed, cleaner and drier screenings, fewer truck trips leaving the plant, and reduced odor.

Screenings Building in Construction

Centrisys Centrifuges

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 efficiency Centrisys centrifuges.

Digester Floating Cover Repairs

The repairs include corrections to leaking sumps and truss chords, Coal tar patching and installation of anti-rotation casters.

Before

After

The following operation and maintenance (O&M) actions have been implemented at the CSO treatment plants as part of the effort to correct past violations and improve operations.

Major Improvement Projects[3] Under Way at CSO Treatment Facilities during 2013

The following activities have been described to EPA and Ecology in regular briefings provided by King County Operations and NPDES staff.

[3] More detail on CSO treatment facility Operations and Maintenance Activities is available in the facility annual reports in the Appendix.

Alki CSO Treatment Plant

Completed actions

- Annual operator wet weather operations refresher training was provided October 2, 2013.
- Operations implemented 7-day staffing through the 2013-14 wet season.
- Set up a PM (Preventative Maintenance) protocol at Alki, to bleed out any gas build-up in the hypochlorite pumps and lines on a regular basis. This PM has already been established at the other CSO facilities and will prevent interruptions to disinfection as a result of hypochlorite off-gassing.

Recent actions

- Wet season weekly event debriefs to share information and confirm operational strategies have been initiated.
- The 63rd Pump Station's regulator gate actuator was replaced and is now functional. A project to fully restore full gate operation (travel) and install a flow meter began predesign in December 2013, and after an alternative is selected for implementation, a project completion date will be identified.
- Operations is continuing to tune the system operational strategies to balance disinfection and dechlorination and evaluating their effects on Alki. During discharges, on-site staff are tuning the disinfection and dechlorination control systems. This work can only be done during actual discharges, which are infrequent.

Current Activities

- Alki's Sodium Bisulfite (SBS) dosing improvement project was delayed by permitting issues and had to be re-bid. (It was completed in July 2014. Fine tuning of the system will occur during the first few events when the system can be operated as designed.)

Upcoming Activities

- A project to add VFDs to the other pumps at 63rd Street Pump Station was initiated. The project began design April 2013. Notice to proceed will likely be given the first quarter of 2015 with completion of construction anticipated mid-2015.

Carkeek CSO Treatment Plant

Completed actions

- The operator wet weather operations training program has been updated to formalize and better document the annual refresher training. This refresher course is provided annually prior to each wet season and as needed during the wet season. The most recent training session was September 4, 2013.
- Operations implemented 7-day staffing through the 2013-14 wet season.

- Automation of the drain valve to remotely send stored CSO flows to the pump station wet well has been completed. This feature was used successfully after the rain-related inflow event in April 2013.

Recent actions

- Wet season weekly event debriefs to share information and confirm operational strategies have been initiated.
- The hypochlorite feed pump and flow meter replacement project was initiated as part of preventive maintenance and King County's continuous improvement process. New hypochlorite pumps were ordered in 2013. Installation will be phased to ensure that one pump will always be available to operate automatically. The first phase started during first quarter of 2014, with the second phase following successful testing of the phase 1 work. Installation is expected to be completed before the start of the 2014-2015 wet season.

Upcoming Activities

- Carkeek flow monitoring improvements await City permits before the contract can go out for bid. The work must be done during dry weather conditions. (The project advertised January 24, 2014, with substantial completion expected September 12, 2014.)

MLK / Henderson CSO Treatment Facilities

Completed actions

- The operator wet weather operations training program has been updated to formalize and better document the annual refresher training. This refresher course is provided annually prior to each wet season and as needed, during the wet season. The most recent training session was September 19, 2013.

Recent, Current, and Upcoming actions

- Wet season weekly event debriefs to share information and confirm operational strategies have been initiated.

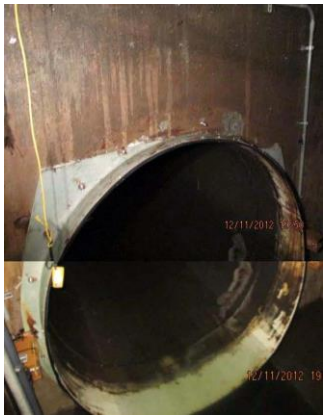
Elliott West/Mercer CSO Treatment Facilities

Completed actions

- The operator wet weather operations training program has been updated to formalize and better document the annual refresher training. This refresher course is provided annually prior to each wet season and as needed, during the wet season. The most recent training session was September 24, 2013.
- Operations implemented 7-day staffing through the 2013-14 wet season.
- The Effluent Sampling Improvement Project was completed February 2013.

Recent actions

- Wet season weekly event debriefs to share information and confirm operational strategies have been initiated.
- Damage to the Elliott West drain gate prevented it from completely closing. This allowed for salt water intrusion, especially during high tides, and prevented representative effluent sampling.
- The damaged Elliott West transition structure flap gate was removed and a new gate was installed November 22, 2013.



Before

After

- The loose connection that prevented the disinfection system from starting automatically during the 9/5-6/13 event was repaired.
- Continuing to test automated storage of flows to provide flushing of the Mercer tunnel.

Current Activities

- The Chlorination / Dechlorination Project was completed. Tuning the control loops with each discharge event is occurring, increasing the level of control complexity with each successful tuning.
- The investigation of low effluent pH is ongoing. Operators sample for alkalinity throughout the process flow and measure field pH during discharge events. Data indicates that Elliott West has slightly higher alkalinity levels in its inflow and effluent, but more data is needed to determine if there any correlations.
- Investigation of the chlorine residual exceedances is ongoing. Initially, intermittent episodes of high residual readings, causing the event average chlorine residual to exceed the limit, were thought to result from inconsistent sodium bisulfite (SBS) feed flow. However, data indicates that SBS flow has been constant and consistent, responding to the increase in final effluent chlorine residual readings.
    - SBS control logic continues to be reviewed
    - SBS mixer condition and operation were inspected and found to be in good operating condition.

- The chlorine residual monitor intake and the SBS induction mixers were inspected for ragging, the SBS mixer spray pattern was checked, and a continuity check of the SBS feed line was performed. The only issue found was that the SBS spray pattern varied with the flow of water. A project to correct that is upcoming.

Upcoming Activities

- A project to repair/replace the city water service connection to the Denny Regulator Station is expected to complete by 3rd quarter 2014. The more reliable water source and greater water pressure are expected to provide more effective back flushing of the final effluent and pre-dechlorination sample pumps and more consistent sodium bisulfite delivery.

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 2013 King County Sewer System Operations Plan (SSOP), 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. The 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, programmable logic controllers (PLCs) will 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'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.

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. For example, in 1992, storage levels behind regulator stations were raised to improve the capture of CSOs.

The amended 2012 King County Long-term CSO Control Plan 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, its existing pretreatment program to minimize CSO impacts from the discharges from 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.

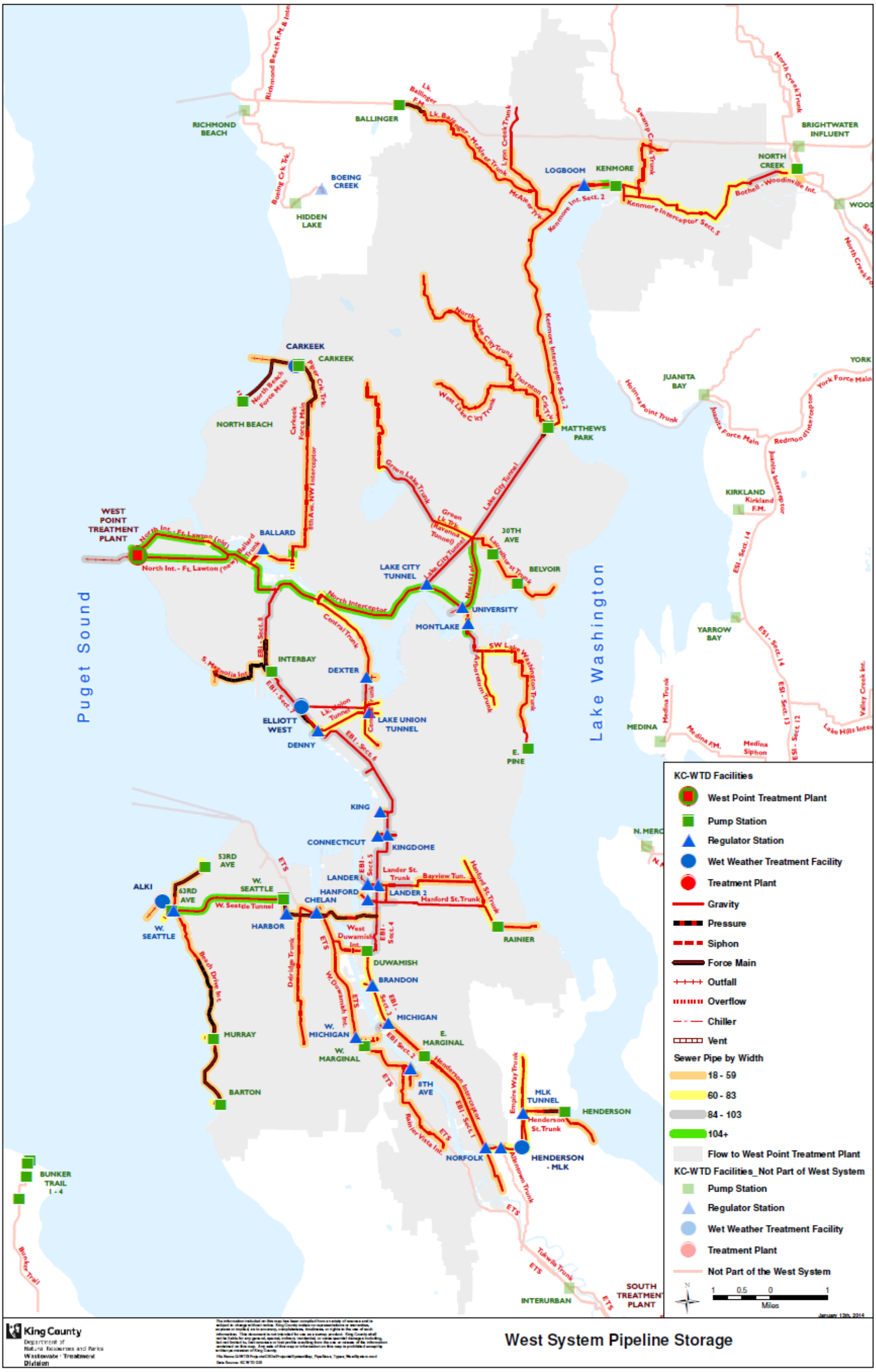


Figure 3. West System Pipeline Storage

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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 current 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), and
- 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 NPDES Permit in 2013.

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

2.4 Control 4—Maximizing Flow to Treatment Plant

Operate the POTW treatment plant 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.[4]

The 2013 King County Sewer System Operations Plan 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 division collection system is essentially a deep in-line tunnel system that can convey a wide range of flows to West Point. 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 mgd to the West Point Treatment Plant. West Point provides secondary treatment for all

[4] POTW = publicly owned treatment works.

base flows (defined by Ecology as 2.25 times the average wet-weather flow) and CSO/primary treatment for flows between 300 million gallons per day (mgd) and the peak hydraulic capacity of 440 mgd.[5] 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 Long-term CSO Control Plan includes two more facilities maximize treatment (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 a battery 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[6] by power outages, mechanical failures, or human error. While these events are rare and are immediately corrected and reported to

[5] mgd = million gallons per day.

[6] Exacerbated CSOs occur during precipitation but are worsened by mechanical failures, power outages, and human error.

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 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 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 preventing dry-weather overflows and exacerbated CSOs. The conveyance system is monitored through SCADA and direct inspection; 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.

- King County developed an information campaign with brochures, TV spots, and a Web page to educate the public that trash should not be flushed to the sewers called "Let's Talk Trash." (Note: As of June 16, 2014, King County updated its educational program to minimize the disposal of trash to the sewer system with a new media outreach program, "This is Flushing Awesome." The ads will run in June and July on KOMO-4 TV, KIRO-7 TV, KONG-6/16 TV, KING-5 TV (website: www.king5.com), Northwest Cable News, KOMO-1000 News Radio, and KIRO-710 AM. In the near future they will be shown on KUNS-TV (Spanish), KFFV-TV (Spanish), AAT-TV (Mandarin Chinese and Vietnamese), El Ray 1360 AM (Spanish), and Radio Luz 1680 (Spanish). More information and video of the ads are available at: http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo/TalkTrash.aspx)
- Encouraging less water use to reduce unnecessary flows in the sewer that contribute to overflows (http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo.aspx).
- Monitoring the development of new floatables control technologies for future CSO control projects.

Observations of the quantity of floatables are noted in logs at each facility and are available for inspection on request. These observations have indicated that additional floatables and solids controls are not needed at this time. Under a July 2009 EPA ordered floatables study, this was confirmed with a three-year project to observe for floatables in water bodies near nine CSOs within four hours of an overflow. 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 implements the Industrial Waste Program (IWP) and 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.

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 combined sewer overflow projects by controlling new and ongoing sources of pollution that could harm the environment or recontaminate cleaned up areas in the waterway. The grants will 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.

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 2013, the projects and recipients are:

- Sanislo Wetland: Restoration of Puget Creek Headwaters ($8,000). Garden Cycles will continue maintenance of the native plant communities of Sanislo School Wetland and neighboring properties bordering Puget Creek's riparian areas. This funding will support the previous accomplishments the group achieved using a 2012 grant.
- Promoting Watershed Stewardship in the Duwamish River Valley Business Community ($15,515). Sustainable West Seattle will raise awareness in the Duwamish River Watershed community about the impact of combined sewer overflows and stormwater runoff on our local waterways with a combination of presentations, information distribution, and earned media through the highly successful Tock-ick Campaign.
- Lower Duwamish Multi-Cultural Green Stormwater Infrastructure Outreach and Education ($30,000). The Environmental Coalition of South Seattle (ECOSS) will

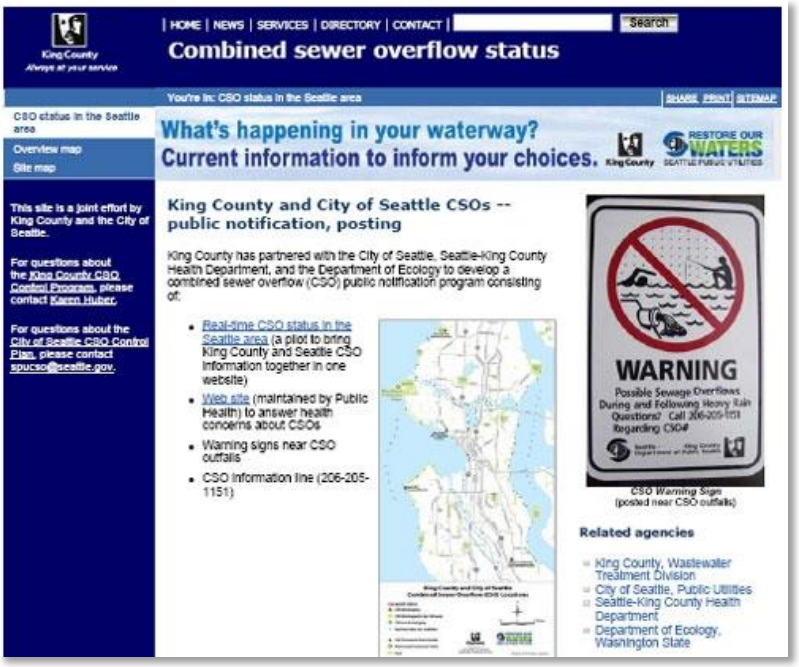
conduct outreach in multiple languages in South Park and similar communities about combined sewer overflows, stormwater, and green retrofit opportunities. Community-wide outreach strategies will be used including canvassing single-family residents, working with residents to champion rain gardens, and using existing demonstration projects.

- Greening the Grounds: Highland Park Improvement Club ($51,155). Sustainable Seattle will implement low-impact development at the Highland Park Improvement Club (HPIC) to support King County's objectives for addressing stormwater challenges associated with the West Michigan CSO. Working closely with HPIC and Highland Park Action Committee, Sustainable Seattle intends to build on-the-ground activities to educate the community about the challenges of stormwater and to demonstrate green infrastructure solutions, supporting the County's efforts in this area.

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. King County recently submitted a draft Source Control Plan for the Lower Duwamish to Ecology.

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) 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.[7] 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 now has access to consolidated information to assist in making choices about use of local waters. An automated email notification system for county CSOs continues to be developed.

In 2013, the CSO Control Program and the CSO Status Web pages had over 11,736 page views (representing 8,778 unique page views, with 65% "bouncing" to deeper page levels). The most page views, 3,737, was logged September 27 to October 2, 2013, corresponding to a moderately large rain event of 2.4 inches with a peak day of 1.7 inches.
In exchange for King County managing the real-time website, SPU agreed to lead community outreach for the program. In 2013, they implemented the following activities:

- Ran a SPU Web story April 25, 2013, viewable by 1,450 employees who could carry the message to their communities
- Discussed the real-time website availability in stakeholder briefings on the CSO program Long-term Control Plan/Integrated Plan during the months of May and June with the following groups:
    - Sustainable Ballard
    - Groundswell NW
    - Ballard District Council
    - North Seattle Industrial Association
    - BINMIC Coalition
    - Ballard Stormwater Consortium
    - Fremont Neighborhood Council
    - Wallingford Community Council
    - Leschi Community Council
    - Environmental Coalition of South Seattle (ECOSS)
    - Georgetown Community Council
    - Greater Duwamish District Council
    - Manufacturing Industrial Council
    - Delridge District Council
    - Holly Park Merchants Association
    - South Park Business Association
    - South Park Neighborhood Association
    - Delridge Community Council
    - Broadview Community Council

[7] http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx.

- Distributed 20 posters and 100 fliers about the real-time website to Seattle Parks who posted them at Parks facilities around town.
- Included an article on the real-time website in the September/October At Your Service SPU Newsletter that accompanies SPU customer utility bills.

In 2013, King County continued ongoing community involvement efforts on the individual project level and the program-wide level 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 CSOs (Rainier Valley Wet Weather Facility) and Brandon and Michigan (Georgetown Wet Weather Treatment Station), are currently developing their outreach and involvement programs. King County continues to develop partnerships throughout the County. 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 it will use to document the existing baseline conditions, evaluate the efficacy of the technology-based controls, and determine the baseline conditions upon which it will 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 CSS.

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, King County's predecessor, 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.

Over the last several years, King County has been working to automate the download of data into our reports and the 20-year moving average. Much of the transfer has been done manually and is somewhat prone to errors. In doing this we are identifying some past mis-counts of overflow events. These corrections will be made after the process is complete and QA/QC has been performed, and will be reported in the 2014 Annual Report.

Under the renewed 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 July 2010 to Ecology 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 2013 and planned for 2014, and where each project is in relation to its schedule of milestones.

The Consent Decree requires the County to report on projects under way and early action CSO control measures. The CSO component of the Ballard siphon replacement project met its completion milestone. All milestones were met for the Beach projects, and the plans to complete control of CSO outfalls 009 (Dexter Avenue Regulator), 027a (Denny Way Regulator), and 037 (Harbor Avenue Regulator). These plans were approved by Ecology September 30, 2013.

Project Name	Action	Date
Ballard Siphon Project (CSO Component)	Completion	December 31, 2013
Magnolia	Start of Construction	December 31, 2013
North Beach	Start of Construction	December 31, 2013
Murray	Start of Construction	December 31, 2013
Barton	Start of Construction	December 31, 2013
Dexter Supplemental	Submitted	September 1, 2013
Denny Supplemental	Submitted	September 1, 2013
Harbor Supplemental[8]	Submitted	September 1, 2013

King County Coordination with Seattle Public Utilities CSO Control Projects

Similar to King County, SPU is implementing CSO control projects under their NPDES permit and consent decree. Unless these projects involve separations or GSI, SPU projects will send captured CSO flows to the regional system for treatment at West Point or at satellite CSO plants. The two agencies have been working together for many years to identify joint project and operational opportunities to improve our efforts and better protect the environment. We have developed agreements to ensure that neither agency will adversely impact the compliance of the other. The following SPU projects have recently begun sending captured CSO to the regional system or will in the near future:

- Windermere basin – NPDES 13: Overflows at the King County Belvoir Pump Station September 2013 were caused by SPU system improvements[9]. DNRP and SPU have worked together to modify operations there to avoid future overflows.
- West Seattle basin – NPDES 95 system improvements complete (date unknown)
- South Henderson basin – NPDES 47C: completed October 2013; has provided notice that flows will come to the regional system in approximately 60 days.

[8] An amendment to the Harbor Plan was submitted at the request of Ecology September 26, 2013

[9] A system improvement is a project to restore a facility to its original constructed capacities and operation.

- South Henderson basin – NPDES 47B/171 will send flows to the regional system in fall 2014.

Verification monitoring is under way. The County will be working with SPU on control and operational strategies as they start up the remaining components of the Henderson project, Windermere, Genesee and Delridge projects, and as they finalize their Leschi and North Union Bay projects.

3.1 Project Summaries

A summary page for each active project follows.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: DSN 003 **Ballard Regulator and partial control of DSN 004 11th Ave. NW**

Project Name: Ballard Siphon Replacement and CSO Control Project

Project Description: Build new siphon tunnel large enough to control the CSO and slip line the existing 2 barrels. More information can be found at: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BallardSiphon.aspx

Schedule:

Milestones	Milestone Date	2013	2014
CSO Control Element Construction Completion	12/31/2013		
Achievement of Performance Standard	12/31/2014		

7/31/14

2013 Accomplishments:

Launched and completed tunnel mining and met Consent Decree milestone.

2013 Challenges and Corrections:

The project team worked effectively with the contractor to develop a plan to overcome challenging mining conditions by amending the soils and modifying the tunnel boring machine.

2014 Activities in Progress or Expected:

Complete project, commission and turnover facility to operations, finalize as-built drawings and operations manuals, and initiate close out procedures.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: S. Magnolia DSN 006

Project Name: South Magnolia Combined Sewer Overflow Control Facility

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

Schedule:

Milestones	Milestone Date	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Submission of Facilities Plan	12/31/2010	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 Performance Standard	12/31/2016											

7/31/14

2013 Accomplishments:

Advertised and awarded a construction contract to Stellar J Corporation for construction of Storage Tank. Received all permits and easement necessary to construct the storage tank. The Port tenant at West yard was relocated.

2013 Challenges and Corrections:

Obtaining all easements. Lengthy negotiation with Port and City of Seattle
Advertising the Conveyance contract

2014 Activities in Progress or Expected:

Approving baseline schedule, review submittals, start construction of storage tank. Obtain resolution on bid protest for Conveyance contract and award the contract. Review submittals for Conveyance contract. Receive the Term Permit for Conveyance contract.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: 046 a & b **North Beach**

Project Name: North Beach Combined Sewer Overflow Control Facility

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

Schedule:

Milestones	Milestone Date	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Submission of Facilities Plan	12/31/2010	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 Performance Standard	12/31/2016											

7/31/14

2013 Challenges and Corrections:

Addressing community issues
Reroute of Metro bus

2013 Accomplishments:

Advertised and awarded the contract to Stellar J Corporation. Completed all the utilities' relocations prior to construction. Received all easements and permits.

2014 Activities in Progress or Expected:

Review and approve a baseline schedule, approve submittals, start excavation for storage tank.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: 056 **Murray**

Project Name: Murray Combined Sewer Overflow Reduction Facility.

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

Schedule:

Milestones	Milestone Date	2010	2011	2012	2013	2014	2015	2016	2017
Submission of Facilities Plan	12/31/2010		Draft Submitted 12/31/2010 Final Submitted 9/2011						
Submission of Final Plans & Specifications	12/31/2012			Draft Submitted 12/21/2012 Final Submitted 4/5/13					
Start of Construction	12/31/2013				10/16/2013				
Construction Completion	12/31/2016								
Achievement Performance Standard	12/31/2017								

7/31/14

2013 Accomplishments:

- Obtained Street Improvement Permit for the City of Seattle
- Awarded contract to Shimmick Construction Company, Inc.
- Issued Notice to Proceed to contractor on October 16, 2013
- Completed demolition of buildings on project site prior to award of construction contract

2013 Challenges and Corrections:

- Obtained resolution of a bid protest from second low bidder. Protest was withdrawn.

2014 Activities in Progress or Expected:

- Construction of the soil nail wall for site stabilization and shoring is complete
- Installation of secant pile shoring for the tank excavation is under way. A 100-foot diameter ring of secant piles, 80 feet deep, will be installed. Installation will take approximately three months.
- Following completion of secant piles, tank excavation will begin during third quarter of 2014.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: 057 **Barton**

Project Name: Barton Combined Sewer Overflow Reduction Facility

Project Description: Construct Green Infrastructure Deep Infiltration Wells and Bioretention Cells for CSO Control. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonCSO-GSI.aspx

Schedule:

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

7/31/14

2013 Accomplishments:

- Obtained Street Improvement Permit for the City of Seattle
- Awarded contract to Goodfellow Brothers
- Relocated trees and gas services from GSI locations prior to the start of the construction contract.
- Obtained Term Permit/ Council Ordinance from Seattle Department of Transportation

2013 Challenges and Corrections:

- Obtain resolution for the Bid protest from Mid-Mountain contractors
- Lengthy negotiations for Term Permit/ Council Ordinance from Seattle Department of Transportation

2014 Activities in Progress or Expected:

- Complete construction of deep infiltration wells on all 15 streets
- GSI Construction of the first eight streets
- Procure Landscape Maintenance contract
- Update Operations and Maintenance manual

Annual CD/CSO Report Project Status

CSOs To Be Controlled: 057 **Barton**

Project Name: Barton Pump Station Upgrade

Project Description: This project increases the capacity of the Barton Pump Station through replacement of existing pumps with larger units providing 33-million-gallons-per-day capacity; adds a standby power generator and an upgraded control system and odor control system. This project is not a Consent Decree project, but is an asset management project that provides additional CSO control. The Barton GSI project builds on this to achieve final CSO control. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonSt.aspx

Schedule:

Milestones	Date	2012	2013	2014
Start of Construction	6/04/2012			
Construction Completion	11/17/2014			

7/31/14

2013 Accomplishments:

Temporary pump station and wet well bypass brought online. Demolition of existing pump station completed and floors, walls and first pump station roof deck poured.

2013 Challenges and Corrections:

Jet grouting of a section of the proposed area could not be completed due to clay in the soil. A sheet pile shoring system was installed instead.

2014 Activities in Progress or Expected:

Completion of pump station, piping, odor control system, back-up generator, and all control systems. Substantial completion and commissioning start expected ahead of schedule by 11/17/14.

Annual CD/CSO Report Project Status

CSOs To Be Controlled: 031 **Hanford #1** (Hanford @ Rainier, Bayview N. & Bayview S.)

Project Name: Rainier Valley Wet Weather Storage Facility

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

Schedule:

Milestones	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								

7/31/14

2013 Accomplishments:

Phase I & II Environmental Sensitivity Assessment completed. Gate 2 Approved 6/2013. SEPA checklist completed. Eco-charrette produced two sustainability score cards. Property acquisition completed, Design Alternative Report Completed, Basis of Design Report and 30% Design Drawings completed. SDOT Street Improvement Plan submitted.

2014 Challenges and Corrections:

Property acquisition at the Bayview site will require condemnation process. Geotechnical support required will need consultant support; all other work will be accomplished by in-house staff.

2014 Activities in Progress or Expected:

Draft facility plan submitted to Department of Ecology 3/14, 10 months ahead of Consent Decree requirement. Gate 3 baseline scope, schedule and budget approved 5/14. 60% design completion expected 6/14. 90% design completion expected 10/14.

Annual CD/CSO Report Project Status

CSOs to Be Controlled: 041 **Brandon** and 039 **S. Michigan**

Project Name: Georgetown Wet Weather Treatment Station

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

Schedule: Project remains on target to meet all required deadlines at this time

Milestones	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											

7/31/14

2013 Accomplishments:

- Request for Proposal for Design Services advertised 5/27/2013
- Gate 1 Project Charter approved by management on 6/27/2013
- Consultant team to support the project was selected and notified 8/5/2013
- Consultant contract signed on 11/25/2013 with CH2MHill / HDR
- Project team kickoff meeting and partnering session completed 12/5/2013

2013 Challenges and Corrections: Negotiations of Phase 1 consultant contract was complex to reach appropriate cost targets Risk workshop and register development were more time consuming than originally anticipated; the delay does not appear to threaten achievement of milestones at this time.

2014 Activities in Progress or Expected:

- Site selection process has narrowed to five plant sites and three outfall locations
- First series of technical workshops have been completed and process selections have been narrowed
- Outfall research has begun and the first of a series of meetings with Ecology has been completed
- Community outreach meetings and activities have begun
- Narrowing to three system alternatives is planned for July and the selection of a preferred site for all system elements is planned for December
- Cross-program meeting with Ecology held

Annual CD/CSO Report Supplemental Compliance Plan Status

CSOs to Be Controlled: 009 **Dexter Regulator**

Project Name: 009 **Dexter Supplemental Compliance Plan**

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.

Schedule: Project remains on target to meet all required deadlines at this time

Milestones	Milestone Date	2011	2012	2013	2014	2015	2016
Complete diversion structure modifications design	June 2014						
Implement modifications	September 2014						
Monitor effectiveness	Through 2015						
Achievement of Performance Standard	12/31/2015						

7/31/14

2013 Accomplishments:
Enhanced monitoring was completed to verify the alternative would achieve control

2013 Challenges and Corrections: None

2014 Activities in Progress or Expected:
Final design of the diversion structure modifications was completed in second quarter 2014, meeting the milestone. Construction will occur in August and is on track to meet the September 2014 milestone. Performance will be monitored. As required in the Consent Decree, 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.

Annual CD/CSO Report Supplemental Compliance Plan Status

CSOs to Be Controlled: 027a **Denny Regulator**

Project Name: 027a **Denny Supplemental Compliance Plan**

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' 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.

Schedule: Project remains on target to meet all required deadlines at this time

Milestones	Milestone Date	2011	2012	2013	2014	2015	2016
Completion of Modifications	12/31/2011						
Achievement of Performance Standard	12/31/2015						

7/31/14

2013 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 for 34 gallons. Performance of these improvements will continue to be monitored.

2013 Challenges and Corrections
Two overflows occurred in 2013, with the 9/28 overflow lasting less than five minutes for 34 gallons. This event was preceded by 10 days of rain, with 1.7 inches falling on 9/28. Additional adjustments are being investigated.

2014 Activities in Progress or Expected:
Performance of these improvements will continue to be monitored and additional adjustments will be investigated. As required in the Consent Decree, 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.

Annual CD/CSO Report Supplemental Compliance Plan Status

CSOs to Be Controlled: 037 **Harbor Regulator**

Project Name: 037 **Harbor Supplemental Compliance Plan**

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.

Schedule: Project remains on target to meet all required deadlines at this time

Milestones	Milestone Date	2011	2012	2013	2014	2015	2016
Evaluation of data for system facilities	June 2013		Completed 6/2013				
Determination of appropriate Alki regulator gate position	October 2013		Completed 8/2013				
Implement gate position change	Summer 2014		Completed 9/2013				
Submit 20-year modeled projection	12/31/2015						
Achievement of Performance Standard	12/31/2015						

7/31/14

2013 Accomplishments:
The evaluation of the data for the whole inter-related system was completed in June, the recommended Alki gate position was determined in August, and the gate was locked 51% open in October.

2013 Challenges and Corrections Harbor experienced two overflows in 2013, one lasting only six minutes.

2014 Activities in Progress or Expected:
Performance will be monitored. As required in the Consent Decree, 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.

3.2 Program Summaries

The Consent Decree required development and implementation of two plans with implementation programs: The Sewer System Operational Plan and the Joint Operations and Optimization Plan with Seattle Public Utilities.

3.2.1 Sewer System Operational Plan

The Consent Decree requires the County to submit its Sewer System Operational Plan (SSOP) for Ecology and EPA approval within 90 days from the effective date of the Consent Decree. The County met this milestone through the submittal of its SSOP on September 27, 2013.

The SSOP was developed in accordance with Appendix C of the Consent Decree. The SSOP pulls together a vast amount of information needed to operate the County's west system; it includes information needed to operate the West Point Treatment Plant, CSO treatment plants, and associated pump stations, interceptors, regulators, tidegates, and outfalls. The SSOP documents the operational strategies used in all of these facilities. The information had been divided into different documents. Because the compilation of this information would result in one very large document that could be impractical to use, County staff obtained the agreement of Robert Grandinetti of EPA Region X to submit the SSOP as an electronic interactive plan on a portable storage device (thumb drive). The SSOP includes interactive links to operations and maintenance manuals, plant manuals, safety plans, maps, and other useful information for the County's west system facilities. King County staff will typically access the SSOP from the County's intranet site, which will link to the most recent versions of the references. In addition, portable storage device versions of the SSOP are provided at each facility as the required CSO Notebook. Key staff will carry storage devices with them for use in the field or from home.

The SSOP was built on existing programs having their own ongoing training, however, it changes how the parts are viewed as a whole with the conveyance system and treatment plant working together. Training on this new perspective and on the use of the final electronic SSOP was provided for King County management on August 21, 2013, and to King County employees through work unit staff meetings over subsequent months. The Division Director sent information to all employees providing information on the Plan and a link to access it on October 21, 2013. Training on the SSOP will become part of ongoing new employee and refresher trainings.

The County provided the City of Seattle with the SSOP storage devices, and a briefing on the SSOP content and use was given to city staff on March 25, 2014. County staff provided a briefing on the SSOP to the Metropolitan Water Pollution Abatement and Advisory Committee, which includes the cities and local sewer utilities that operate sewer systems within the County's wastewater service area. The County provided EPA and Ecology a briefing to show how the interactive plan can be accessed and used on December 11, 2013.

Ecology approved the SSOP on May 29, 2014, and EPA has stated we should expect an approval letter from them shortly.

Because this plan is an electronic document, it is linked to the most current base documents, such as Operations and Maintenance manuals. Once a year in August, the team representatives of Operations, Offsite, and CSO control planning will go over the plan to ensure that the electronic links still work. And every third year (beginning in 2016), the team will review the Plan to ensure that base documents are being updated as needed and that any new or changed information is reflected in this plan. Any recommended changes will be shared with the member communities. Thumb drives will be replaced.

3.2.2 Joint Operations and System Optimization Plan Between City of Seattle and the County

Appendix D of the Consent Decree requires the County to "submit to EPA and Ecology for their approval a Joint Operations and System Optimization Plan (Joint Plan) that the County will work with the City of Seattle in jointly developing and which satisfies the requirements of Appendix D" of the Consent Decree. The Consent Decree requires that the Joint Plan be submitted no later than March 1, 2016.

A planning team comprised of dedicated staff from Seattle Public Utilities and King County is making progress on the Joint Plan. A progress report was submitted to EPA and Ecology in December 2013, in accordance with each agency's consent decree.

In 2013, the Joint Operations & System Optimization Plan (Joint Plan) team began development of the Joint Plan by focusing on understanding the interconnectedness between each agency's systems, each agency's operable facilities, and the greatest areas for optimization opportunities. Highlights of the year include the following:

- Completed a Memorandum of Understanding (MOU) committing both agencies to development of the Joint Plan by March 1, 2016.
- More than 60 staff--management, technical staff (planners, engineers, modelers), and operators--from each agency participated in 10 educational activities over the course of the year. The educational activities involved facility tours and technical presentations of key operable facilities in each agency's system.
- Shared operational objectives were developed and jointly approved for use, which satisfies the Consent Decree requirement for shared operational objectives for King County Wastewater Treatment Division's and Seattle Public Utilities' (SPU's) combined systems.
- Divided the combined wastewater system managed by SPU and King County into 13 planning basins for joint operations analysis. Basins were delineated based on hydrologic

and hydraulic parameters, operational strategies, locations of significant operable facilities, and input from technical staff.

- Developed and approved two early actions for implementation: Formation of a Joint System Event Debrief Committee and formation of a Joint Operations Information Sharing Team (JOIST).

More detail on these activities is included in the 2013 Annual Progress Report submitted to EPA and Ecology December 19, 2013.

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 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 2013. More information can be found in the appendices.

4.1 Annual Rainfall

The 2009 renewed NPDES permit requires that rainfall data be reported for each CSO event as measured by the nearest King County owned rain gauge. Rainfall data for 2013 are included in Appendices A and B of this annual report.

The annual rainfall for 2013, as an average over local rain gauges, was 24.93 inches, which is much less than the long-term Sea-Tac annual average of 37.07 inches. May (4.06 inches) and September (4.48 inches) had the highest rainfall.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures, broken pipelines, and manholes. Overflows that are not caused by rainfall are called dry-weather overflows (DWOs). In King County's system, DWOs 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."

Two DWOs occurred in the County system in 2013, both at Murray Pump Station due to power outages. Murray's back-up generator will be installed by 2016.

Table 1. Dry-Weather Overflow Events, 2013

Date	Location	Estimated Volume (gallons)	Estimated Duration (minutes)	Receiving Water	Cause and Resolution
February 20	Murray Pump Station	18,000	5	Puget Sound	ERTS #639422Power outage (dry-weather overflow)
March 2	Barton Pump Station	1,000 – 44,000	7	Puget Sound	ERTS #13-0670; temporary pump failure during construction (dry-weather overflow)
November 2	Murray Pump Station	333,000	42	Puget Sound	ERTS #645015; wind storm (dry-weather overflow)

4.3 Annual Untreated CSO Events

West Point's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at ten CSO locations not currently monitored by SCADA: 11th Avenue NW, 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 lower than normal rainfall, King County CSOs discharged a total of 385.9 MG over 150 events during 2013. This single year's data represents an 86 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 occurred in April (4.06 inches) and September (4.48 inches), however, September had significantly more overflow volume with 197 MG discharged compared to April with 35.5 MG. 123.5 MG overflowed in the September 5-6 storm alone representing 32 percent of the annual total.

An unusual overflow at the Belvoir Pump Station occurred during the large September 5-6 storm. The City of Seattle and King County staff met and reviewed the data. It appears that the first phase of the City's Windermere project--called "Windy Jr." --was not operated within the conditions established when King County agreed to accept the new flows. Seattle has modified its operations of these facilities to drain within the agreed upon conditions and prevent impacts at Belvoir. This experience has demonstrated how interconnected the two systems are and how important translation of design information to operations is. King County will continue to work closely with Seattle on control strategies and start-up of operations.

The 2009 NPDES permit requires "event-based" data reporting by CSO site. Appendix A of this report lists the untreated events from County CSOs during 2013. These data are also provided in electronic form to Ecology along with this report.

The 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 5 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/Norfolk.

The following sections summarize performance and compliance at each facility during 2013. 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 the Lake Washington Ship Canal 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 had 10 CSO-related bypasses during 2013. The total volume was 111.7 MG. All occurred when total plant flows were above 300 mgd, and the final blended effluents met NPDES limits. These 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 from a continuously operating primary plant to a CSO treatment plant was completed in 2001. There were three filling events and three discharge events at the Alki CSO Treatment Plant during 2013. The plant received a total inflow of 25.08 MG and discharged 13.02 MG.

Overall TSS removal was 57.25 percent which met the annual 50 percent TSS removal limit, however, the annual average settleable solids limit was exceeded with 0.45 ml/L/hr. compared to the limit of 0.3 ml/L/hr. One event did not meet the minimum pH limit. All other limits were met.

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 from a continuously operating primary plant to a CSO treatment plant was completed in 1994. In 2013, the Carkeek CSO Treatment Plant operated five times with a total inflow volume of 2.56 MG, and discharged two times with a total discharge volume of 1.52 MG.

The monthly average and event-based limits for settleable solids were met. The annual 50 percent TSS removal limit was also met; TSS removal averaged 54.9 percent. Fecal coliform residual chlorine levels met the effluent 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 2013 there were 46 filling events totaling 511.9 MG and 5 discharge events with a total volume of 69.6 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; TSS removal was 56.3 percent. However, the annual average SS limit was not met with 1.16 ml/L/hr. compared to the 0.3 ml/L/hr. limit: the total residual chlorine limit was not met six days; and the instantaneous minimum pH was not met one day.

The treatment and discharges throughout 2013 occurred without a marine flap gate in place, resulting in seawater solids contaminating the samples. Staff made operational changes to deal with seawater intrusion into the effluent pipeline and into the wet well at EWCSO facility. An increased monitoring effort has started after the new marine flap gate was installed and at the start of 2014 monitoring included additional laboratory solids analysis of all flows sampled from EWCSO.

The new chlorination system, part of the Chlorination–Dechlorination Improvement Project, is currently in use. Since the new chlorination control system became operational in November 2011, King County has continued to evaluate and fine-tune the chlorination and dechlorination controls at each discharge event. King County continues to monitor the performance of the new system and has made several improvements.

More detail can be found in the Mercer/Elliott West annual report in Appendix E of this report.

4.4.5 Henderson/Norfolk CSO Treatment and Storage Facilities

The Henderson/Norfolk tunnel storage and treatment system was brought online in May 2005. As is typical of intermittently operated facilities, adjustments to systems and operations to

achieve intended performance continued during the first few years. The Henderson/Norfolk system had two filling events in 2013 totaling 2.68 MG and no discharge events.

The TSS removal limit was achieved at an average of 79.4 percent by capture and transfer for treatment at South Plant, meeting the 50 percent removal limit.

For several years King County and City of Seattle have been discussing a potential to transfer captured CSO from several of their Henderson Lake Washington facilities to the King County's Henderson/MLK conveyance and treatment tunnel system for more cost-effective control. King County's analysis of the proposed transfers suggests that the volumes to the Henderson Pump Station will reduce its level of service from one overflow in ten years, but will not exceed the state standard. It also appears that the volumes to the treatment tunnel can be accommodated within the permit limits, with a small increase in the volume of treated discharge to the Duwamish River. Agreements have been signed between the two agencies on the conditions of these transfers, verification of flows and any impacts, and actions that would need to be taken should these flows cause King County to become non-compliant. Seattle has completed one retrofit for basin 47 and will soon begin sending those flows. King County will work with Seattle on control strategies and start-up of operations.

The annual report for Henderson/Norfolk system is provided in Appendix F of this report.

5.0 Summary of Consent Decree Violations Since CD Became Effective

Section VIII. 43. of the Consent Decree requires the listing of any violations of the Consent Decree in the annual report. The following table identifies CD violations since the CD became effective July 3, 2013. Detail on causes, corrective actions, and schedules is provided in the facility annual reports in the Appendix.

Date of event	Facility	Description of Violation(s)	Date of verbal Notification (if required)	Date of 10-day letter
9/5-6/2013	Elliott West	Disinfection failure; pH; chlorine residual violations	within 24 hours of becoming aware of delayed chlorine application	9/16/2014
9/5-6/2013	Alki	Disinfection failure; pH violations	within 24 hours of becoming aware delayed chlorine application	9/16/2013
9/28/2013	Alki	Disinfection failure	within 24 hours of becoming aware delayed chlorine application	10/7/2013
9/28/2013	Elliott West	Disinfection failure Chlorine violation	within 24 hours of becoming aware	10/8/2013
11/2/2013	Murray Pump Station[10]	DWO; power failure	within 24 hours of becoming aware of power failure	11/8/2013
12/31/2013	Alki	Exceedance of annual settleable solids limit	In annual report	7/31/14
12/31/2013	Elliott West	Exceedance of annual settleable solids limit	In annual report	7/31/14

[10] The February 20, 2013 DWO at Murray recorded in Section occurred before the CD was final.

6.0 Twenty-Year Moving Average of Event Frequencies

The renewed NPDES permit for the West Point Treatment Plant, effective July 1, 2009, implements 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 Consent Decree recognizes this performance level.

The standard of "not more than one untreated discharge event per year per outfall on average" is now 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, a full 20 years of data are not available for all sites because the upgraded SCADA system was brought online and began to report data for all sites over time. Locations lacking the full 20 years of measured data are noted. For sites where new control facilities have been built and which 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. Ecology has directed that treated discharges from the CSO treatment facilities that are categorized as the "one untreated event per year" for permit limit compliance purposes should be considered as treated and should not be counted in the 20-year data.

The following 16[11] CSOs were identified as controlled through the monitoring and modeling data:

30th Avenue NE Pump Station
53rd Avenue SW Pump Station
63rd Avenue SW Pump Station
8th Ave S Regulator[12]
SW Alaska Street
Ballard
Belvoir Pump Station
Canal Street
East Duwamish Pump Station and Siphon
West Duwamish Siphon
Henderson Pump Station
East Marginal Pump Station
Matthews Park Pump Station
Martin Luther King Way (MLK)
Norfolk
E Pine Street Pump Station
Rainier Avenue Pump Station.

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.

[11] Ballard control will be reported in the 2014 annual report.

[12] Modeled and monitored data at 8th Ave. S. 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 the 8th Avenue South Regulator Station will be confirmed at that time.

Table 2. Untreated CSO Events, Averages, and Baselines, 1994–2013

CSO Site	Discharge Serial Number (DSN)	1994	1995	1996[b]	1997[c]	1998	1999	2000[d]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	20-Year Average	20-Year Average for Compliance	1983 Baseline (24-hr interevent)
11th Ave. NW[e]	004	20	30	18	21	10	12	14	14	8	8	6	11	22	10	7	16	19	16	20	12	**14.7**		16
30th Ave. NE[f]	049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	**0.0**	<1
3rd Ave. W[g]	008	4	10	15	9	8	4	1	11	4	6	4	5	13	6	3	9	8	7	13	5	**7.3**		17
53rd Ave. SW[h]	053	NM	NM	NM	NM	NM	NM	0	0	0	0	0	0	2	1	0	0	0	0	1	0	**0.3**	**0.3**	<1
63rd Ave[h]	054	NM	NM	NM	NM	NM	NM	0	0	0	2	0	1	0	0	0	0	1	1	3	2	**0.7**	**0.7**	2
8th Ave./ W Marginal Way	040	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.3**	**0.3**	6
Alaska St. SW[e,f]	055	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1[t]	0	1	1	1	0	**0.3**	**0.3**	1
Ballard	003	11	12	11	8	3	5	2	2	0	4	2	1	5	2	1	8	6	7	13	6	**5.5**		13
Barton[h]	057	NM	NM	NM	NM	NM	NM	0	0	0	3	4	5	11	3	1	2	4	1	4	5	**3.1**		9
Belvoir	012	0	0	1	1	0	1	0	0	0	2	2	0	1	1	0	0	1	0	1	1	**0.6**	**0.6**	<1
Brandon St.[k]	041	37	53	55	40	31	32	30	30	21	28	21	27	11	NM	3[t]	16	11	7	12	7	**24.8**		36
Canal St.	007	0	0	3	1	2	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	**0.6**	**0.6**	<1
Chelan	036	15	8	15	8	5	5	2	7	2	3	1	2	5	2	0	0	3	4	13	4	**5.2**		7
Denny Way	027a	33	49	54	37	23	23	25	26	15	25	20	11	9	1	2	4	2	2	1	2	**18.2**		32
Dexter	009	10	23	22	21	13	10	10	12	9	15	8	12	20	9	3	11	13	8	13	6	**12.4**		15
Duwamish E[e]	034	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	**0.2**	**0.2**	<1
Duwamish W[e,o]	035	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1	0	1	0	0	1	0	0	1	**0.4**	**0.4**	<1
Hanford #1																								30
Hanford @ Rainier[e, j]	031a	0	0	20[i]	14	17	5	0	0	3	6	8	NM	16	4	6	14	13	13	18	10	**8.3**		NA
Bayview South[e]	031b	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM[s]	0	1	2	**0.5**		NA
Bayview North[e]	031c	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5[r]	2	7	4	**4.7**		NA
Hanford #2	032	17	32	20	17	17	18	17	13	10	12	16	15	26	12	8	17	17	15	23	9	**16.6**		28
Harbor Ave.[l]	037	13	47	39	1	1	0	0	2	0	2	0	3	5	2	0	0	1	1	3	2	**6.1**		30
Henderson[q]	045	*0*	*0*	*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	19	27	17	18	11	14	10	14	12	16	15	20	27	7	3	15	18	15	13	2	**14.7**		16
Kingdome (formerly Connecticut)	029	8	15	14	11	3	0	1	0	0	0	2	5	4	5	1	8	6	2	11	6	**5.1**		29
Lander St.	030	7	26	16	12	10	15	11	10	10	12	9	8	28	8	6	19	17	15	25	8	**13.6**		26
Magnolia S[e]	006	28	39	48	34	19	5	0	0	5	18	17	26	30	21	26	25	38	22	36	16	**22.7**		25

CSO Site	Discharge Serial Number (DSN)	1994	1995	1996[b]	1997[c]	1998	1999	2000[d]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	20-Year Average	20-Year Average for Compliance	1983 Baseline (24-hr interevent)
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**	**0.0**	<1
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**	**0.0**	<1
Michigan St.	039	13	0	0	0	0	10	8	12	8	9	6	5	13	5	3	10	12	14	16	8	**7.6**		34
Michigan W	042	2	5	6	6	3	3	2	7	5	4	1	3	8	4	0	8	9	3	5	2	**4.3**		5
MLK Jr. Way[q]	013	*0*	*0*	*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	4	11	7	2	7	0	2	0	5	11	5	6	NM	0	1	3	10	8	18	7	**5.6**		6
Murray[h]	056	NM	NM	NM	NM	NM	NM	0	0	0	3	5	10	10	3	1	11	8	3	5	2	**4.4**		5
Norfolk St.[q]	044a	*0*	*0*	*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[e]	048b	13	19	22	20	13	9	11	10	1	6	6	10	13	4	3	13	6	15	13	3	**10.5**		18
North Beach Wet Well[m]	048a	w/inlet	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	**10.2**		18
Pine St. E	011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	**0.0**	<1
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**	**0.0**	<1
Terminal 115[e,n]	038	NM	NM	NM	NM	NM	NM	NM	NM	NM	2	0	2	7	4	0	3	3	0	1	1	**2.1**		4
University	015	10	15	13	9	10	4	3	5	4	4	4	3	12	5	3	9	8	6	13	4	**7.2**		13
Rainfall (inches)		32.37	39.34	42.28	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	40.30	32.2	42.57	24.93	**34.1**		37.00

Notes for Table 2:

[b] The West Point Treatment Plant computers (SCADA) were down from 10/17/1996 to 11/17/1996.
[c] CSO “event” definition changed to be based on a 48-hour dry period.
[d] CSO “event” definition changed to be based on a 24-hour dry period.
[e] Portable monitors are used at 11th Avenue NW, Alaska Street SW, Bayview North and South, East and West Duwamish, Hanford South Magnolia, North Beach Inlet, and Terminal 115. The Bayview North monitor was installed in 2010; the Bayview South monitor was installed in 2011.
[f] Monitoring began in June 1992 at Belvoir, 30th Avenue NE, Alaska Street SW, South Magnolia, East Marginal, Matthews Park, MLK Jr. Way, East Pine, Rainier avenue, Henderson, and North Beach.
[g] The 3rd Avenue West monitor was down 6/2006 through 11/2006.
[h] Monitoring began in June 2000 at 53rd Avenue, 63rd Avenue, Barton, and Murray.
[i] Monitoring began at Hanford #1 (Hanford @ Rainier) in January 1996.
[j] The monitor at Hanford #1 was down June 2000 through May 2001 and was not operating properly 6/1/2007 to 12/17/2007.
[k] 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
[l] No data were recorded at Harbor Avenue April and May 2004.
[m] Reporting of the North Beach wet well began in June 2005.
[n] Monitoring began in June 2003 at Terminal 115.
[o] Monitoring began at West Duwamish in June 2005.
[q] 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.
[r] Hanford #1 (Bayview N) began monitoring in 2010
[s] Hanford #1 (Bayview S) began monitoring in 2011
[t] Corrected data from 2010 report

7.0 Post-Construction Monitoring

King County's Post-Construction Monitoring Plan (PCMP) was approved by Ecology 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 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 done as described in the PMCP. Details can be found in Appendix C, Sampling and Analyses Plan. Subsurface characterization at University CSO was conducted in 2013. 2012 sediment characterization data 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 2015.

Appendices

Appendix A. Untreated CSO Events, January–December 2013

Appendix B. Treated CSO Events, January–December 2013

Appendix C. Alki CSO Treatment Plant 2013 Annual Report

Appendix D. Carkeek CSO Treatment Plant 2013 Annual Report

Appendix E. Mercer/Elliott West CSO Control Facilities 2013 Annual Report

Appendix F. Henderson/Norfolk CSO Control Facilities 2013 Annual Report

Appendix A
Untreated CSO Events

January–December 2013

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
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	1/9/13 6:03 AM	1/9/13 9:01 AM	2.97	171,662	1.45	25.88	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	4/5/13 2:26 AM	4/5/13 2:46 AM	0.33	21,215	0.83	16.37	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	4/7/13 5:26 AM	4/7/13 6:53 AM	1.45	80,035	2.24	68.50	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	9/6/13 12:35 AM	9/6/13 3:11 AM	2.60	83,755	1.20	21.88	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	9/28/13 4:48 PM	9/28/13 5:06 PM	0.30	30,666	1.24	12.70	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	9/29/13 8:41 PM	9/29/13 8:58 PM	0.28	18,596	1.92	40.42	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/8/13 11:04 PM	1/9/13 9:25 AM	10.35	975,677	1.46	26.17	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/20/13 6:10 AM	3/20/13 6:46 AM	0.60	14,491	0.83	14.35	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	4/5/13 2:20 AM	4/5/13 5:15 AM	2.92	805,485	1.02	18.65	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	4/7/13 4:40 AM	4/7/13 7:18 AM	2.63	723,381	2.26	68.92	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	4/13/13 5:10 PM	4/13/13 5:32 PM	0.37	95,843	0.33	27.67	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	5/13/13 1:50 PM	5/13/13 2:15 PM	0.42	145,507	0.29	0.73	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	6/20/13 7:47 PM	6/20/13 8:25 PM	0.63	53,269	0.40	5.30	

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
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	6/25/13 8:19 PM	6/25/13 8:38 PM	0.32	36,399	0.48	17.08	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/6/13 12:37 AM	9/6/13 3:21 AM	2.73	2,481,363	1.21	22.15	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/28/13 4:53 PM	9/28/13 5:24 PM	0.52	597,586	1.24	12.70	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/29/13 8:20 PM	9/29/13 9:20 PM	1.00	357,366	1.93	40.72	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/7/13 5:04	11/7/13 5:47	0.72	112,718	0.43	10.53	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/8/13 10:43 PM	1/9/13 9:58 AM	11.25	377,100	0.95	21.35	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/20/13 12:38 AM	3/20/13 6:53 AM	6.25	55,355	0.84	14.95	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/5/13 2:13 AM	4/5/13 5:23 AM	3.17	349,790	0.59	20.15	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/6/13 5:28 AM	4/7/13 7:38 AM	26.17	551,732	1.93	70.10	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/13/13 7:43 PM	4/13/13 8:03 PM	0.33	10,244	0.38	30.18	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/29/13 6:18 AM	4/29/13 6:28 AM	0.17	494	0.19	13.34	
006	Magnolia Overflow	Elliot Bay/Puget Sound	5/13/13 13:53	5/13/13 14:28	0.58	166,982	0.12	0.49	
006	Magnolia Overflow	Elliot Bay/Puget Sound	6/24/13 12:18 AM	6/24/13 12:28 AM	0.17	3,286	0.22	17.41	
006	Magnolia Overflow	Elliot Bay/Puget Sound	6/25/13 7:53 AM	6/25/13 8:43 PM	12.83	41,792	0.51	16.76	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/6/13 12:28 AM	9/6/13 3:28 AM	3.00	1,059,301	1.21	20.48	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/15/13 7:08 PM	9/15/13 7:23 PM	0.25	36,034	0.18	8.65	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/22/13 2:33 PM	9/23/13 9:53 AM	19.33	45,083	0.42	22.03	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/28/13 9:08 AM	9/29/13 9:23 PM	36.25	607,727	1.56	39.74	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/1/13 9:18	10/1/13 9:33	0.25	5,626	0.07	0.41	

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
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/7/13 4:36 AM	11/7/13 2:00 PM	9.40	170,709	0.68	18.95	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/18/13 10:36 PM	11/18/13 10:54 PM	0.30	8,227	0.56	11.49	
007	Canal Street Overflow	Lake Washington Ship Canal			0.00	0			
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/9/13 2:20 AM	1/9/13 6:00 PM	15.67	299,971	1.49	27.15	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	4/7/13 5:41 AM	4/7/13 7:31 AM	1.83	142,508	2.27	69.08	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	5/13/13 1:40 PM	5/13/13 1:51 PM	0.18	16,294	0.29	0.73	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	9/6/13 12:24 AM	9/6/13 3:38 AM	3.23	790,822	1.21	22.15	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	9/28/13 4:40 PM	9/28/13 5:45 PM	1.08	45,246	1.26	13.33	
009	Dexter Ave Regulator	Lake Union	1/9/13 2:22 AM	1/9/13 2:36 AM	0.23	10,464	0.87	20	
009	Dexter Ave Regulator	Lake Union	4/7/13 6:02 AM	4/7/13 6:51 AM	0.82	12,103	2.11	68.92	
009	Dexter Ave Regulator	Lake Union	8/29/13 5:40 PM	8/29/13 6:05 PM	0.42	389,153	0.55	15.88	
009	Dexter Ave Regulator	Lake Union	9/6/13 12:29 AM	9/6/13 3:19 AM	2.83	4,146,310	1.25	20.40	
009	Dexter Ave Regulator	Lake Union	9/28/13 12:10 PM	9/28/13 5:17 PM	5.12	567,405	1.05	13.05	
009	Dexter Ave Regulator	Lake Union	9/29/13 8:52 PM	9/29/13 9:08 PM	0.27	6,709	1.69	40.57	
011	E Pine St. Pump Station Emergency Overflow	Lake Washington			0.00	0			
012	Belvoir Pump Station Emergency Overflow	Lake Washington	9/6/13 1:30 AM	9/6/13 3:09 AM	1.65	76,123	1.49	20.37	
013	Martin Luther King Way Trunkline Overflow	Lake Washington via storm drain			0.00	0			
014	Montlake Overflow	Lake Washington Ship Canal	1/9/13 1:40 AM	1/9/13 10:01 AM	8.35	6,283,444	1.63	27.33	
014	Montlake Overflow	Lake Washington Ship Canal	4/7/13 5:48 AM	4/7/13 7:40 AM	1.87	2,056,242	2.04	69.03	
014	Montlake Overflow	Lake Washington Ship Canal	4/13/13 5:44 PM	4/13/13 5:57 PM	0.22	400,584	0.58	28.27	

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
014	Montlake Overflow	Lake Washington Ship Canal	9/6/13 12:24 AM	9/6/13 3:19 AM	2.92	10,025,487	1.50	20.47	
014	Montlake Overflow	Lake Washington Ship Canal	9/28/13 12:12 PM	9/28/13 5:42 PM	5.50	4,642,011	1.19	13.10	
014	Montlake Overflow	Lake Washington Ship Canal	9/29/13 8:53 PM	9/29/13 9:19 PM	0.43	774,957	1.78	40.55	
014	Montlake Overflow	Lake Washington Ship Canal	11/7/13 5:35 AM	11/7/13 9:01 AM	3.43	332,743	0.6	11.52	
015	University Regulator	Lake Washington Ship Canal	1/9/13 6:13 AM	1/9/13 10:49 AM	4.60	11,677,362	1.63	27.33	
015	University Regulator	Lake Washington Ship Canal	4/7/13 6:13 AM	4/7/13 7:24 AM	1.18	2,982,344	2.04	69.03	
015	University Regulator	Lake Washington Ship Canal	9/6/13 12:34 AM	9/6/13 3:35 AM	3.02	19,137,125	1.51	20.70	
015	University Regulator	Lake Washington Ship Canal	9/28/13 5:18 PM	9/28/13 5:40 PM	0.37	858,909	1.18	13.02	
018	Matthews Park Pump Station Emergency Overflows	Lake Washington			0.00	0			
027a	Denny Way Regulator	Elliott Bay	9/6/13 12:45 AM	9/6/13 2:50 AM	2.09	14,989,648	1.18	19.99	
027a	Denny Way Regulator	Elliott Bay	9/28/13 12:08 PM	9/28/13 12:13 PM	0.09	34	0.64	7.53	
028	King Street Regulator	Elliott Bay	9/6/13 12:22 AM	9/6/13 2:15 AM	1.88	609,811	1.19	19.40	
028	King Street Regulator	Elliott Bay	9/28/13 12:04 PM	9/28/13 5:01 PM	4.95	117,064	1.09	12.17	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/9/13 7:07 AM	1/9/13 12:18 PM	5.18	3,229,874	1.76	29.42	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	4/7/13 5:32 AM	4/7/13 8:51 AM	3.32	2,045,614	1.68	70.25	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	9/6/13 12:53 AM	9/6/13 5:04 AM	4.18	13,101,522	1.37	21.18	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	9/28/13 12:06 PM	9/28/13 7:16 PM	7.17	12,204,482	1.15	14.20	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	9/29/13 9:11 PM	9/29/13 10:07 PM	0.93	39,649	1.71	40.88	

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
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/7/13 8:26 AM	11/7/13 9:04 AM	0.63	165,631	0.60	13.42	
030	Lander St Regulator	Elliott Bay	1/9/13 7:07 AM	1/9/13 3:33 PM	8.43	34,790,518	1.76	29.42	
030	Lander St Regulator	Elliott Bay	3/20/13 1:27 AM	3/20/13 8:52 AM	7.42	5,294,801	0.99	16.55	
030	Lander St Regulator	Elliott Bay	4/7/13 5:25 AM	4/7/13 10:49 AM	5.40	5,735,553	1.71	72.60	
030	Lander St Regulator	Elliott Bay	9/6/13 1:12 AM	9/6/13 6:06 AM	4.90	7,152,717	1.26	21.48	
030	Lander St Regulator	Elliott Bay	9/28/13 12:13 PM	9/28/13 7:45 PM	7.53	10,740,973	1.41	14.33	
030	Lander St Regulator	Elliott Bay	9/29/13 9:20 PM	9/30/13 3:00 PM	17.67	949,470	2.55	56.37	
030	Lander St Regulator	Elliott Bay	11/7/13 6:57 AM	11/7/13 10:42 AM	3.75	14,721,865	0.70	15.40	
030	Lander St Regulator	Elliott Bay	11/18/13 9:01 PM	11/18/13 9:35 PM	0.57	289,780	0.69	29.65	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/9/13 1:22	1/9/13 13:45	12.38	9,967,089	1.76	29.42	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/20/13 6:11	3/20/13 6:41	0.50	138,081	0.90	14.63	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	4/7/13 5:35 AM	4/7/13 7:32 AM	1.95	1,602,318	1.61	69.13	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	6/20/13 9:15 PM	6/20/13 9:20 PM	0.08	298	0.21	5.82	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	6/25/13 8:31 PM	6/25/13 8:49 PM	0.30	78,362	0.71	61.65	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	8/29/13 5:35 PM	8/29/13 5:48 PM	0.22	85,008	0.37	13.93	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	9/6/13 12:20 AM	9/6/13 3:14 AM	2.90	10,310,988	1.21	20.42	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	9/28/13 12:01 PM	9/28/13 5:29 PM	5.47	5,113,821	1.33	12.88	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	9/29/13 8:11 PM	9/30/13 12:48 PM	16.62	973,734	2.54	55.75	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/7/13 5:08 AM	11/7/13 8:55 AM	3.78	865,627	0.68	13.65	

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
031b	Hanford #1 (Bayview S.)	Duwamish River via Diagonal Storm Drain	9/6/13 12:45 AM	9/6/13 2:20 AM	1.58	191,552	1.11	19.53	
031b	Hanford #1 (Bayview S.)	Duwamish River via Diagonal Storm Drain	9/28/13 12:30 PM	9/28/13 12:40 PM	0.17	18,029	0.75	7.97	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	8/29/13 5:30 PM	8/29/13 5:35 PM	0.08	3,244	0.37	13.93	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	9/6/13 12:20 AM	9/6/13 2:05 AM	1.75	2,589,774	1.08	19.32	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	9/28/13 12:00 PM	9/28/13 5:10 PM	5.17	1,414,830	1.32	12.40	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/7/13 8:25 AM	11/7/13 8:30 AM	0.08	4,933	0.67	13.52	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/9/13 7:09 AM	1/9/13 6:42 PM	11.55	18,593,028	1.82	85.45	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/20/13 1:30 AM	3/20/13 11:05 AM	9.58	16,503,065	1.02	17.38	
032	Hanford #2 Regulator	Duwamish River - East Waterway	4/7/13 5:26 AM	4/7/13 3:31 PM	10.08	15,435,139	1.76	75.88	
032	Hanford #2 Regulator	Duwamish River - East Waterway	4/19/13 1:20 PM	4/19/13 2:03 PM	0.72	412,506	0.47	22.23	
032	Hanford #2 Regulator	Duwamish River - East Waterway	9/6/13 1:16 AM	9/6/13 6:54 AM	5.63	19,751,866	1.26	21.48	
032	Hanford #2 Regulator	Duwamish River - East Waterway	9/28/13 12:12 PM	9/28/13 8:47 PM	8.58	19,496,515	1.41	14.33	
032	Hanford #2 Regulator	Duwamish River - East Waterway	9/29/13 9:23 PM	9/30/13 2:28 PM	17.08	5,959,429	2.55	56.37	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/7/13 7:15 AM	11/7/13 4:10 PM	8.92	3,527,648	0.88	21.33	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/18/13 6:15 PM	11/18/13 10:49 PM	4.57	4,518,039	0.71	30.43	
033	Rainier Ave. Pump Station	Lake Washington			0.00	0			
034	East Duwamish	Duwamish River			0.00	0			
035	West Duwamish	Duwamish River	9/6/13 2:11 AM	9/6/13 2:17 AM	0.10	294	1.10	19.45	

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
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/9/13 7:09 AM	1/9/13 1:55 PM	6.77	1,232,325	1.53	28.32	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	4/7/13 6:00 AM	4/7/13 8:14 AM	2.23	121,776	1.62	69.80	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	9/6/13 1:28 AM	9/6/13 4:34 AM	3.10	1,154,666	1.26	21.48	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	9/28/13 12:54 PM	9/28/13 5:48 PM	4.90	12,531	1.37	13.20	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	1/9/13 8:37 AM	1/9/13 2:28 PM	5.85	2,224,467	1.53	28.32	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	9/28/13 4:55 PM	9/28/13 5:01 PM	0.10	65,378	1.32	12.40	
038	Terminal 115 Overflow	Duwamish River	9/6/13 2:15 AM	9/6/13 3:10 AM	0.92	31,840	1.32	20.58	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/9/13 2:20 AM	1/9/13 11:05 AM	8.75	6,434,790	1.82	85.45	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/20/13 6:22 AM	3/20/13 8:09 AM	1.78	8,290	0.96	16.53	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	4/7/13 4:59 AM	4/7/13 7:37 AM	2.63	1,597,136	1.81	69.38	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	8/29/13 5:34 PM	8/29/13 6:09 PM	0.58	589,916	0.73	38.18	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/6/13 12:25 AM	9/6/13 3:57 AM	3.53	8,591,189	1.36	21.42	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/28/13 12:09 PM	9/28/13 5:39 PM	5.50	2,652,030	1.14	13.42	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/29/13 8:33 PM	9/30/13 1:11 PM	16.63	1,929,099	2.30	56.97	

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
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/7/13 5:14 AM	11/7/13 6:25 AM	1.18	495,204	0.50	11.70	
040	8th Ave South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River			0.00	0			
041	Brandon Street Regulator	Duwamish River	1/9/13 2:41 AM	1/9/13 12:17 PM	9.60	6,390,373	1.82	85.45	
041	Brandon Street Regulator	Duwamish River	4/7/13 6:40 AM	4/7/13 7:26 AM	0.77	242,838	1.61	69.13	
041	Brandon Street Regulator	Duwamish River	8/29/13 5:27 PM	8/29/13 9:19 PM	3.87	330,894	0.38	15.03	
041	Brandon Street Regulator	Duwamish River	9/6/13 12:30 AM	9/6/13 4:32 AM	4.03	5,239,843	1.26	21.48	
041	Brandon Street Regulator	Duwamish River	9/28/13 12:07 PM	9/28/13 5:12 PM	5.08	1,425,706	1.32	12.40	
041	Brandon Street Regulator	Duwamish River	9/30/13 12:01 PM	9/30/13 12:37 PM	0.60	564,371	2.54	55.75	
041	Brandon Street Regulator	Duwamish River	11/7/13 5:17 AM	11/7/13 8:37 AM	3.33	2,841	0.68	13.65	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	1/9/13 7:00 AM	1/9/13 11:11 AM	4.18	769,930	1.82	85.45	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	9/6/13 2:04 AM	9/6/13 3:26 AM	1.37	99,586	1.34	20.83	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River							
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			

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
048a	North Beach Pump Station (wet well)	Puget Sound	1/8/13 10:55 PM	1/9/13 9:16 AM	10.35	93,370	1.46	26.16	
048a	North Beach Pump Station (wet well)	Puget Sound	3/20/13 5:59 AM	3/20/13 6:27 AM	0.46	5,468	0.92	14.35	
048a	North Beach Pump Station (wet well)	Puget Sound	4/5/13 2:34 AM	4/5/13 3:15 AM	0.69	13,288	0.88	16.84	
048a	North Beach Pump Station (wet well)	Puget Sound	4/7/13 4:35 AM	4/7/13 6:46 AM	2.19	55,042	2.23	68.36	
048a	North Beach Pump Station (wet well)	Puget Sound	4/13/13 4:47 PM	4/13/13 5:02 PM	0.25	10,660	0.23	27.18	
048a	North Beach Pump Station (wet well)	Puget Sound	5/13/13 1:36 PM	5/13/13 1:48 PM	0.20	9,889	0.29	0.73	
048a	North Beach Pump Station (wet well)	Puget Sound	6/20/13 7:31 PM	6/20/13 7:40 PM	0.15	8,486	0.32	4.79	
048a	North Beach Pump Station (wet well)	Puget Sound	6/25/13 7:40 AM	6/25/13 8:24 PM	12.72	27,822	0.48	17.08	
048a	North Beach Pump Station (wet well)	Puget Sound	8/29/13 5:30 PM	8/29/13 6:02 PM	0.54	15,192	0.33	15.54	
048a	North Beach Pump Station (wet well)	Puget Sound	9/5/13 8:51:16	9/6/13 2:49:06	17.96	107,224	1.20	21.74	
048a	North Beach Pump Station (wet well)	Puget Sound	9/28/13 16:39:20	9/28/13 16:59:16	0.33	21,987	1.23	12.36	
048a	North Beach Pump Station (wet well)	Puget Sound	9/29/13 20:31:39	9/29/13 21:00:48	0.49	16,419	1.92	40.41	
048a	North Beach Pump Station (wet well)	Puget Sound	11/7/13 4:55 AM	11/7/13 *5:08 AM	0.22	4,480	0.37	9.96	
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/9/13 6:20 AM	1/9/13 8:45 AM	2.42	27,525	1.43	25.62	
048b	North Beach Pump Station (inlet structure)	Puget Sound	4/7/13 6:15 AM	4/7/13 6:30 AM	0.25	5,307	2.21	68.15	

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
048b	North Beach Pump Station (inlet structure)	Puget Sound	9/6/13 12:25 AM	9/6/13 2:15 AM	1.83	430,191	1.08	21.18	
049	30th Avenue NE Pump Station	Lake Washington			0.00	0			
052	53rd Avenue SW Pump Station	Puget Sound			0.00	0			
054	63rd Avenue SW Pump Station	Puget Sound	1/9/13 8:35 AM	1/9/13 9:48 AM	1.22	187,199	1.51	27.98	
054	63rd Avenue SW Pump Station	Puget Sound	9/28/13 4:54 PM	9/28/13 5:21 PM	0.45	476,858	1.32	12.40	
055	SW Alaska Street Overflow	Puget Sound			0.00	0			
056	Murray Street Pump Station	Puget Sound	2/20/13 3:00 AM	2/20/13 3:05 AM	0.08	18,000			DWO
056	Murray Street Pump Station	Puget Sound	9/28/13 12:05 PM	9/28/13 4:57 PM	4.87	137,183	1.31	12.30	
056	Murray Street Pump Station	Puget Sound	9/30/13 12:12 PM	9/30/13 12:24 PM	0.20	79,779	2.54	55.75	
056	Murray Street Pump Station	Puget Sound	11/2/13 11:21 AM	11/2/13 12:03 PM	0.70	332,606	0.43	7.30	DWO
057	Barton Street Pump Station	Puget Sound	6/23/13 11:24 PM	6/23/13 11:45 PM	0.35	133,427	0.31	17.45	
057	Barton Street Pump Station	Puget Sound	9/6/13 12:31 AM	9/6/13 2:28 AM	1.95	1,304,174	1.23	19.98	
057	Barton Street Pump Station	Puget Sound	9/22/13 1:14 PM	9/22/13 1:17 PM	0.05	5,136	0.27	8.82	
057	Barton Street Pump Station	Puget Sound	9/28/13 11:53 AM	9/28/13 5:12 PM	5.32	662,989	1.51	33.02	
057	Barton Street Pump Station	Puget Sound	9/30/13 11:52 AM	9/30/13 12:30 PM	0.63	111,053	2.93	76.38	
			Total (does not include DWO volumes)			**385,860,203**			

The North Beach Inlet structure flowmeter stopped recording properly on 9/25/13. Data is missing from 9/25/13-10/1/13.

Appendix B
Treated CSO Events

January–December 2013

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**[13]	Puget Sound	1/8/13 4:52 PM	1/9/13 2:04 PM	21.20	55,720,000	1.49	27.15
001	**West Point Wastewater Treatment Plant**	Puget Sound	3/6/13 8:34 PM	3/6/13 10:12 PM	1.54	800,000	0.51	11.85
001	**West Point Wastewater Treatment Plant**	Puget Sound	3/20/13 1:00 AM	3/20/13 9:34 AM	5.45	1,580,000	0.92	17.13
001	**West Point Wastewater Treatment Plant**	Puget Sound	4/7/13 5:06 AM	4/7/13 12:54 PM	7.44	16,290,000	2.41	73.52
001	**West Point Wastewater Treatment Plant**	Puget Sound	4/13/13 7:15 PM	4/13/13 9:55 PM	2.48	200,000	0.53	30.95
001	**West Point Wastewater Treatment Plant**	Puget Sound	4/19/13 12:16 PM	4/19/13 9:17 PM	1.26	100,000	0.51	27.37
001	**West Point Wastewater Treatment Plant**	Puget Sound	9/6/13 2:10 AM	9/6/13 6:50 AM	4.41	6,720,000	1.24	23.32
001	**West Point Wastewater Treatment Plant**	Puget Sound	9/28/13 12:50 PM	9/28/13 8:21 PM	7.39	20,570,000	1.29	14.47
001	**West Point Wastewater Treatment Plant**	Puget Sound	9/29/13 9:11 PM	9/29/13 11:34 PM	2.35	6,210,000	1.93	40.72
001	**West Point Wastewater Treatment Plant**	Puget Sound	11/7/13 6:52 AM	11/7/13 9:37 AM	1.83	3,500,000	0.46	14.08
027b	**Elliott West CSO Treatment Facility**	Puget Sound	1/9/13 12:52 PM	1/9/13 3:00 AM	9.83	18,430,000	1.79	27.55

[13] All West Point Events Occurred When Plant at or above 300 mgd

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	3/20/13 1:12 PM	3/20/13 6:24 AM	5.80	8,630,000	0.93	17.29
027b	**Elliott West CSO Treatment Facility**	Puget Sound	4/7/13 12:49 PM	4/7/13 6:38 AM	5.26	5,200,000	3.25	74.80
027b	**Elliott West CSO Treatment Facility**	Puget Sound	9/6/13 11:49 AM	9/6/13 1:17 AM	10.50	24,060,000	1.7	28.60
027b	**Elliott West CSO Treatment Facility**	Puget Sound	9/28/13 2:15 PM	9/28/13 8:21 PM	6.05	13,320,000	2.45	14.3
044b	**MLK/ Henderson CSO Treatment Facility Outfall**	Duwamish Waterway	No 2013 Discharges	ND	ND	ND	ND	ND
046b	**Carkeek CSO Treatment Facility Outfall**	Puget Sound	1/10/13 6:15 AM	1/9/13 7:49 AM	9.58	660,000	1.49	27.15
046b	**Carkeek CSO Treatment Facility Outfall**	Puget Sound	9/6/13 4:16 AM	9/6/13 1:14 AM	2.93	860,000	1.23	22.88
051b	**Alki CSO Treatment Facility Outfall**	Puget Sound	1/9/13 1:29 PM	1/9/13 7:27 AM	6.08	5,650,000	1.53	28.32
051b	**Alki CSO Treatment Facility Outfall**	Puget Sound	9/6/13 5:12 AM	9/6/13 2:45 AM	2.37	3,180,000	1.27	21.48
051b	**Alki CSO Treatment Facility Outfall**	Puget Sound	9/28/13 7:40 PM	9/28/13 4:51 PM	2.32	4,190,000	1.62	14.33
					Total volume	**195,870,000**		

Appendix C
Alki CSO Treatment Plant
Annual Report

January–December 2013

Executive Summary

This 2013 annual report summarizes performance of King County's Alki CSO Treatment Plant. The plant came online for CSO treatment in 1998. Alki operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

2013 was characterized by lower than average rainfall for the year and as a result low inflow and discharge volumes occurred. A total of 22.3 inches of rain fell in calendar year 2013 as measured at the rain gauge located at Chelan Pump Station, the nearest gauge to the Alki Treatment Plant. The annual rainfall recorded at Seattle-Tacoma International Airport (Sea-Tac) was 32.6 inches for 2013 compared to the historical annual average measured at Sea-Tac of 37.6 inches (15 year average).

There were three filling events and three discharge events during calendar year 2013. The Alki CSO Treatment Plant received 25.1 MG and discharged 13.02 MG. The annual average total suspended solids (TSS) removal for all discharge events during the year was 54 percent, thereby meeting the permit level of 50 percent annual removal. Alki CSO Treatment Plant did not meet the annual average settleable solids limit with the average measured as 0.45 ml/L/hr. and the permit limit being 0.3 ml/L/hr. The facility did meet both the fecal coliform maximum monthly geomean and the total residual chlorine maximum daily average. Alki CSO Treatment Plant did not meet the instantaneous minimum pH of less than 6.0. The minimum pH of 5.8 was measured on September 5, 2013.

Table C-1. Alki CSO Permit Performance in 2013

Parameter	Performance	Permit Conditions
Number of Discharge Events	**3**	29 [a]
Discharge Volume (MG)	**13.0**	108 [a]
Annual Average Settleable Solids (mL/L/hr.)	**0.45**	0.3
Event Maximum Settleable Solids (mL/L/hr.)	**0.70**	1.9
Annual Average %Total Suspended Solids	**54**	50%
Fecal Coliform, Maximum Monthly Geomean (MPN# /100 mL)	**173**	400
Instantaneous Minimum/Maximum Effluent pH	**5.8/7.4**	≥6.0 / ≤9.0
Total Residual Chlorine, Maximum of Daily averages (ug/L)	**40**	490

Suspended and Settleable Solids

Including all the discharge events in 2013, the annual total suspended solids (TSS) removal was calculated to be 54.0 percent, therefore, Alki met the annual average TSS removal permit level of 50 percent. The annual average settleable solid of 0.45 ml/L/hr. was greater than the permit level of 0.3 ml/L/hr. The 2013 event maximum settleable solids were measured to be 0.70 ml/L/hr. which occurred on September 28, 2013. Alki met the settleable solids event maximum for each discharge events during 2013 with the permit limit of 1.9 ml/L/hr. event maximum. A possible contributing factor in Alki not meeting the settleable solids annual average in 2013 was the over seven-month inter-event period between the January and September events. The two events in September had the highest levels of settleable solids for 2013 and this "first flush" event forced high solids into the plant. There were no subsequent discharge events at Alki that would benefit from the "first-flush."

Fecal Coliform Bacteria

The maximum of monthly fecal coliform geomean was 173 counts /100 ml occurring in September, thereby meeting the permit limit of 400 counts /100 ml. The annual average of monthly fecal coliform geomeans was 109. During the September 5, 2013 discharge, there was a disinfection failure due to the hypochlorite feed pumps becoming gas bound. To prevent future incidents of gas-bound hypochlorite feed pumps, as a Preventive Maintenance (PM) practice, the hypochlorite pumps will be exercised regularly to bleed off gas build up in pumps. This PM has already been established at the other CSO facilities.

Total Residual Chlorine

Maximum of daily average effluent total residual chlorine (TRC) during the 2013 reporting year was 40 μg/L. The maximum daily average TRC occurred during the September 28, 2013 event. The maximum daily average effluent chlorine residual did not exceed the permit limit of 234 μg/L.

Instantaneous Minimum and Maximum Effluent pH

The daily instantaneous minimum and maximum pH during the 2013 reporting period was 5.8 and 7.4, respectively. Therefore, Alki did not meet the 2013 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 during the September 5, 2013 discharge. During this treatment and discharge event, a disinfection failure occurred as well and these two incidents are interconnected. During this event, the hypochlorite system did start automatically, however, the hypochlorite feed pumps were gas bound and failed to feed hypochlorite. The dechlorination system currently uses a flow-paced dosing program to apply bisulfite. At the start of discharge, the bisulfite was being added to flow which did not receive any disinfection (and no residual chlorine to de-chlorinate) and this led to the pH being depressed below 6.0.

Operation and Maintenance

Highlights of Operation and Maintenance activities at Alki during 2013:

- Conducted annual CSO refresher training for the operators in October 2013.
- Shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals.
- Completed handover of operations and maintenance of Alki CSO TP to West Section.
- Continued to conduct debriefings with operations and maintenance 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.
- Purchased new online amperometric chlorine residual analyzers for the inflow (intermediate chlorine residual), final effluent, and pre-dechlorination chlorine residual monitoring and reporting. Installation scheduled for summer 2014.
- Alki CSO TP dechlorination system improvements project started construction in 2013 and is scheduled to be completed by end of summer 2014.

Dechlorination System Improvements Project

The project to improve the dechlorination system started construction in 2013 and is anticipated to be completed by end of summer 2014. The project will increase the storage capacity of sodium bisulfite solution (SBS) from the old storage volume of 1000 gallons to 3000 gallons and install new larger capacity feed pumps. In addition, the project includes two SBS feed control "modes"- a flow paced feed mode based on Alki plant flow and an automatic pre-dechlorination chlorine residual mode in which SBS feed is controlled by both plant flow and pre-dechlorination chlorine residual. Operators will be able to select between these feed control modes based on the operating circumstance.

Near Future Operation

During Alki facility operation as is 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. King County staff will continue to investigate and make any necessary adjustments in the operations and maintenance of the Alki CSO facility. In addition, King County staff responding to Alki CSO Treatment Plant will:

- Complete installation of three new online amperometric chlorine residual analyzers.

- Evaluate and make any necessary adjustments to the dechlorination system after the Dechlorination System Improvement Project is completed. This project is scheduled to be completed in time for the 2014 wet season.
- Continue with the project for new Variable Frequency Drives for the 63rd Street pumps.

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

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MGD)	Alki Discharge Event Number	Alki Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% removal	Alki Effl. Daily Settl Solids (ml/L/hr)	Alki Effl. Settl Solids Event Max (avg) (ml/L/hr)	Alki Avg daily Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
January	9	1	12.87	1	5.65	5,835	2,859		0.2	0.2	45	0	6.0/7.4
	Instant. Min/Max pH												**6.0/7.4**
	Event/Daily Max									**0.20**		**0**	
	Monthly Total/Avg/Geomean	**1**	**12.87**	**1**	**5.65**		**2,859**	**51.0%**			**45**		
February	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
April	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0**	**ND**	**ND**						**ND**		

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MGD)	Alki Discharge Event Number	Alki Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% removal	Alki Effl. Daily Settl Solids (ml/L/hr)	Alki Effl. Settl Solids Event Max (avg) (ml/L/hr)	Alki Avg daily Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0**	**ND**	**ND**						**ND**		
September	5	1	5.4	1.00	3.18		1,876		0.40	0.40	30000	20	5.8/6.8
	28	2	6.9	2	4.19	8,124	3,198		0.70	0.70	1	40	6.0/6.5
	Instant. Min/Max pH												**5.8/6.8**
	Event/Daily Max									**0.70**		**40**	
	Monthly Total/Avg/Geomean	**2**	**12.21**	**2**	**7.37**		**5,074**	**55.6%**			**173**		
October	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
November	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0.0**	**ND**	**ND**						**ND**		
December	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geomean	**0**	**0**	**ND**	**ND**						**ND**		
	Total	**3**	**25.08**	**3**	**13.02**	**17,261**	**7,933**						
	Inst. pH Min/Max												**5.8/7.4**
	Max (GEM, SS, TRC)									**0.70**	**173**	**40**	
	Annual Average							**54.0%**		**0.45**	**109**		

Notes:

 # ND = No Discharge **^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.**

*** NR = Not Reported due to lab error**

% NS = No sample collected

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total Alki CSO TSS lbs-in	Total Alki CSO TSS lbs Discharged	Annual Average Alki CSO %TSS Removal	Maximum of Event Averages Settleable Solids (ml/L/hr)	Annual Average Settleable Solids Concentra-tion (ml/L/hr)	Max of Monthly Geomean Alki CSO Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Alki CSO Effl. Fecal Coliforms (#/100 ml)	Max of Daily Averages of Alki CSO Effl. Res. Cl2 (ug/l)	Instant Min /Max pH	Comments
Includes all events	25.1	13.0	17,261	7,933	54.0%	0.70	0.45	173	109	40	5.8/7.4	

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Appendix D
Carkeek CSO Treatment Plant
Annual Report

January–December 2013

Executive Summary

This report is the twentieth annual report summarizing the performance of King County's Carkeek CSO Treatment plant. The plant began to operate as a CSO treatment facility on November 1, 1994. The facility operates under the NPDES permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1. The current permit went into effect on July 1, 2009, and expired June 30, 2014.

2013 was characterized by lower than average rainfall for the year. The total rainfall for the reporting period was 18.97 inches, as measured by the Ballard Station rain gauge. The reported 2013 annual rainfall measured at Seattle-Tacoma International Airport (Sea-Tac) was 32.6 inches. The historical annual average measured at Sea-Tac is 37.6 inches (15 year average).

Carkeek CSO Treatment Plant performed well in 2013. The annual average solids removal as measured by the percent Total Suspended Solids (TSS) removal was 54.9%. All permit parameters were met at the current NPDES permit limits.

Performance in 2013

In 2013, there were five inflow events into the Carkeek CSO plant, and two resulted in discharges to Puget Sound out of the Carkeek CSO outfall. The total inflow and discharge volumes for the reporting period were 2.56 MG and 1.52 MG, respectively. The performance of the plant for the year 2013 is summarized below in Table D-1.

Table D-1. Carkeek CSO Permit Performance in 2013

Parameter	Performance	Permit Conditions
Number of Discharge Events	**2**	10 [a]
Discharge Volume (MGD)	**1.52**	46 [a]
Annual Average Settleable Solids (mL/L/hr)	**0.3**	0.3
Event Maximum Settleable Solids (mL/L/hr)	**0.5**	1.9
Annual Average %Total Suspended Solids	**54.9%**	50%
Fecal Coliform, Maximum Monthly Geomean (MPN# /100 mL)	**55**	400
Instantaneous Minimum/Maximum Effluent pH	**6.2/7.7**	≥6.0 / ≤9.0
Total Residual Chlorine, Maximum of Daily averages (ug/L)	**70**	490

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

Suspended and Settleable Solids

Total Suspended Solids (TSS) removal averaged 54.9 percent, thereby meeting the annual TSS removal permit limit of 50 percent. The annual settleable solids (SS) for the year averaged 0.3 ml/L/hr and the event maximum settleable solid was 0.5 ml/L/hr., thereby meeting both the annual average SS and event maximum (maximum of the event average SS concentration).

Fecal Coliform Bacteria

The maximum monthly geomean during the 2013 reporting period was 55 counts/100 ml that occurred during the January 9, 2013 discharge, thereby meeting the permit limit of 400 counts/100ml. The annual average of the monthly geomeans was 28 counts/100ml.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2013 reporting period was 6.2 and 7.9, respectively. Therefore, Carkeek met the 2013 permit limits for instantaneous minimum pH equal to or greater than 6.0, and maximum pH equal to or less than 9.0.

Total Residual Chlorine

Maximum of daily average effluent total residual chlorine (TRC) during the 2013 reporting year was 70 µg/L. The maximum daily average effluent chlorine residual met the permit limit of 490 µg/L.

Operation and Maintenance

King County staff in early 2013, modified the sodium bisulfite (SBS) feed line to include a manifold and a bypass so staff could switch feed pumps and allow continuous chemical feed without disrupting any repair or pump replacement work. In addition, the SBS storage tank and outlet line were drained, cleaned and flushed in preparation for a new shipment of SBS on September 2013. Sodium hypochlorite was also replaced with fresh hypochlorite in September. Annual CSO refresher training for the off-site operations staff was provided in September 2013.

The project to automate the pump-down of stored CSO volumes back to the pump station and return to West Point was completed in early 2013. This allows King County to maximize the available storage of CSO flows. Initial reports from the King County Off-site operators were positive about the ease of use and the effectiveness to quickly return CSO volumes back to West Point.

Near Future Operation

During Carkeek facility'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, King County has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons.

Future projects to improve Carkeek's performance include replacement of the hypochlorite feed pumps with newer and more reliable pumps, the addition of a hypochlorite feed flow meter, and improved flow metering to increase the accuracy and reliability of inflow and effluent flow measurements. The hypochlorite feed pump replacement project, including the addition of hypochlorite feed flow meter, is scheduled to be completed in summer of 2014. King County staff is currently evaluating alternatives to improve flow monitoring because the current means to measure the influent and discharge flows are limited to 34 and 23 MGD, respectively. The alternative analysis and design phases of the flow monitoring improvement project began during 2011-2012. The project is projected to be completed in 2014.

Table D-2. Carkeek Annual Plant Performance 2013

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Dis-charge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Dis-charged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/L/hr)	Carkeek Effl. Settleable Solids Event Max (avg) (ml/L/hr)	Carkeek Daily Avg Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine (ug/l)	Daily Min/Max pH
January	9	1	0.95	1	0.66	864	311		0.1	0.1	55.0	8	6.2/7.7
	Inst. Min/Max pH												**6.2/7.7**
	Event/Daily Max									**0.1**		**8**	
	Mon. Total/Avg/Geomean	**1**	**0.95**	**1**	**0.66**	**864**	**311**	**63.98**			**55.0**		
February	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
		Mon.	**0**	**0**	**ND**	**0.0**	**0.0**				**ND**		
March	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0**	**0**	**ND**	**0**	**0**				**ND**		
April	4	1	0.05	ND	ND	55	2		ND	ND	ND	ND	ND
	6	2	0.12	ND	ND	57	2		ND	ND	ND	ND	ND
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**2**	**0.170**	**0**	**ND**	**113**	**4**	**96.67**			**ND**		
May	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0**	**0**	**ND**	**0**	**0**	**ND**			**ND**		
June	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0**	**0**	**ND**	**0**	**0**	**ND**			**ND**		
July	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0.00**	**0**	**ND**	**0.0**	**0.0**	**ND**			**ND**		

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Dis-charge Volume (MGD)	Total Influen t TSS (lbs)	Total Effluent TSS Dis-charged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/L/hr)	Carkeek Effl. Settleable Solids Event Max (avg) (ml/L/hr)	Carkeek Daily Avg Effl. Fecal Coliform s (#/100 ml)	Carkeek Effl. Residual Chlorine (ug/l)	Daily Min/Ma x pH
August	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0**	**0**	**ND**	**0**	**0**	**ND**			**ND**		
Septembe	5	1	1.18	1	0.86	1270	901		0.5	0.5	1	70	7.6/7.9
	28	2a	0.18	ND	ND	656	117		ND	ND	ND	ND	ND
	29	2b	0.08	ND	ND	68	7		ND	ND	ND	ND	ND
	Inst. Min/Max pH												**7.7/7.9**
	Event/Daily Max									**0.5**		**70**	
	Mon. Total/Avg/Geomean	**2**	**1.44**	**1**	**0.86**	**1993**	**1025**	**48.60**			**1**		
October	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0.00**	**0**	**ND**	**0**	**0**	**ND**			**ND**		
November	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0.00**	**0**	**ND**	**0**	**0**	**ND**			**ND**		
December	No Inflow or Discharges												
	Inst. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Mon. Total/Avg/Geomean	**0**	**0.00**	**0**	**ND**	**0**	**0**	**ND**	**0.1**		**ND**		
January - December 2013	**Total**	**5**	**2.56**	**2**	**1.52**	**2969**	**1339**						
	Inst. pH Min/Max												**6.2/7.9**
	Max (GEM, SS, TRC)									**0.5**	**55.0**	**70**	
	Annual Average							**54.9%**		**0.3**	**28.00**		

Notes: # ND= No Discharge. * NR= Not Reported due to lab error.

	No. of Discharge Events	Inflow Volume (MGD)	Discharge Volume (MGD)	Total Carkeek TSS lbs-in	Total Carkeek TSS lbs Discharged	Annual Average Carkeek %TSS Recovery	Maximum of Event averages Carkeek Settleable Solids (ml/L/hr)	Annual Average Carkeek Settleable Solids (ml/L/hr)	Maximum of Monthly Geomean Carkeek Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomeans Carkeek Effl. Fecal Coliform #/100 ml	Maximum of Daily Averages of Carkeek Effl. Res. Cl2 (ug/l)	Instant. Min/Max pH	Comments
Discharge Events	**2**	**2.56**	**1.52**	**2969**	**1339**	**54.9%**	**0.5**	**0.3**	**55**	**28**	**70**	**6.2/7.9**	

Appendix E
Mercer/Elliott West CSO Treatment Plant
Annual Report

January–December 2013

Executive Summary

This document constitutes the eighth annual report of the Mercer/Elliott West CSO Treatment Facility (EWCSO). It summarizes the performance and operation of the facility during January−December 2013.

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. The current permit went into effect on July 1, 2009, and expired June 30, 2014. Effective June 2011, a new fecal coliform limit was implemented by Ecology as a monthly Geomean of 154 counts/ 100 ml with no more than 10% of the discharge days to exceed 473 counts/100 ml. In calculating the geomean, Ecology directed that a value of "one" for non-discharge days be used.

2013 was characterized by lower than average rainfall for the year and as a result there were low inflow and discharge volumes reported. Total rainfall recorded in 2013 was 33.1 inches as measured at the Denny Way rain gauge station which is located at 3165 Alaskan Way in Seattle. The reported 2013 annual rainfall measured at Seattle-Tacoma International Airport (Sea-Tac) was 32.6 inches. The historical annual average measured at Sea-Tac is 37.6 inches (15 year average).

2013 marks the ninth year of operation of EWCSO by King County. There were 21 inflow events and five discharge events in 2013. EWCSO received a total of 153.4 million gallons (MG) of CSO flow out of which 69.6 MG was treated and discharged through the EWCSO outfall at the Denny Regulator Station located in Myrtle Edwards Park. Over 53 percent of the total discharged CSO volume occurred in September 2013. The average total suspended solids (TSS) removal for all discharge events during the year was 48.5 percent. After designating the March 19-20, 2013 event as the one "untreated" discharge per year and excluding its data, the average TSS annual removal was 56.3 percent.

In late 2012, King County staff discovered the marine flap gate located on the marine side of the transition structure of the EWCSO effluent pipeline had failed and broke off its thimble. For the entire 2012-2013 wet weather season, EWCSO did not have a functioning marine flap gate to prevent seawater from entering the effluent pipeline and back into the facility's wet well. The operation of EWCSO was modified during this period to prevent seawater from entering the collection system and ending up at the treatment plant, and possibly impacting its operation and

processes. The modified operation also minimized seawater corrosion of pumps and other equipment at EWCSO. This impacted the solids return to West Point and removal efficiency at EWCSO. In November 2013, a new fabricated marine flap gate was installed and the marine seal was verified.

Performance in 2013

Table E-1 summarizes permit performance in 2013.

Table E-1. Mercer/Elliott West CSO Permit Performance in 2013 (amended)

Parameter	Performance	Permit Conditions
Number of Discharge Events	**5**	NA
Discharge Volume (MGD)	**69.6**	NA
Annual Average Settleable Solids (mL/L/hr)	**1.16**	0.3
Monthly Event Maximum Settleable Solids (mL/L/hr) (max month event max in year displayed	**1.85**	1.9
Annual Average %Total Suspended Solids	**48.5%**	50%
Fecal Coliform, Maximum Monthly Geomean (MPN# /100 mL) (max in year displayed)	**70**	400
Instantaneous Minimum/Maximum Effluent pH (min/max in year displayed)	**5.8/8.5 Min exceeded once**	≥6.0 / ≤9.0
Total Residual Chlorine, Maximum of Daily averages (ug/L)	**6 days above Max – see text & spreadsheet**	490

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

Suspended and Settleable Solids

Including all the discharge events in 2013, the annual TSS removal was calculated to be 48.5 percent, compared to 64.5 percent removal for 2012. Excluding the March 19-20, 2013 event as the one "untreated" event per year, the annual average TSS removal was calculated as 56.3 percent.

The solids removal during 2013 can be explained in part by the difficulty of operating EWCSO without the marine flap gate. The marine flap gate was reported in late 2012 as broken from the thimble and lodged in the outfall pipe during an inspection of the transition structure for EWCSO's 96-inch effluent pipeline. King County staff managed to remove the broken flap gate and started an emergency project to fabricate, procure, and install a new thimble and marine flap gate. The treatment and discharges throughout 2013 occurred without a marine flap gate in place.

Staff made operational changes to deal with seawater intrusion into the effluent pipeline and into the wet well at EWCSO facility. The operational changes that had the largest impact on the

solids removal were to shut off at times dewatering pumps and main pumps as return flows to West Point treatment plant via the Elliott Bay Interceptor (EBI), then later slowly return the CSO diluted with seawater using only the smaller dewatering pumps to the EBI in order to minimize the impact of high levels of seawater to the treatment process at West Point Treatment Plant. It was determined that rain-related non-discharge return flows (designated as inflows per Permit Monitoring Report) had high seawater content as measured by very high laboratory conductivity of inflow samples. Therefore, unable to determine what portion of the inflows were from seawater intrusion only, return flows during a discharge event were sampled and reported. This resulted in reduced return volumes and solids to be quantified.

In summer of 2013, King County completed the project to automate flushing of the Mercer Tunnel and began automated flushing during the fall season. However, seawater intrusion into EWCSO facility as described above prevented monitoring efforts to ascertain the effectiveness of the automated tunnel flushing. An increased monitoring effort started after the new marine flap gate was installed and at the start of 2014, monitoring included additional laboratory solids analysis of all flows sampled from EWCSO. This effort is currently ongoing. With these increased monitoring efforts in place, the effectiveness of tunnel flushing on solids removal will be determined and any necessary modifications to the automation program will be identified.

Meeting the settleable solids (SS) permit limits continues to be a challenge at EWCSO. The annual SS concentration for the 2013 discharge events averaged 1.16 ml/L/hr. (the current permit limit is 0.3 ml/L/hr.), and the monthly event maximum during 2013 was 1.85 ml/L/hr. On two separate discharge days, the daily SS measured as high as 2.5 ml/L/hr. Due to the ongoing challenges to meeting the SS permit limits, King County started a project with the help of consultant engineers to determine the issues with solids removal and SS compliance at EWCSO.

Fecal Coliform Bacteria

In 2013, EWCSO met the fecal coliform permit. The maximum monthly geomean for fecal coliform bacteria was calculated as 70 counts/100 ml. The annual average of monthly geomeans was 31 counts/100 ml. The highest fecal coliform count for 2013 was determined at 700 counts/ 100 ml and it occurred during the September 5, 2013 discharge.

Effective June 2011 (and through the end of the current permit cycle in June 2014), the fecal coliform permit limit and calculation methodology changed for Elliott West CSO discharges. The new monthly geometric mean for fecal coliform limit is 154 counts/100 ml and no more than 10 percent of discharge days can exceed 473 counts/100 ml. Non-discharge days are assigned a value of “one” for the calculation. If discharges occur on fewer than 10 days in the month, then one day may exceed 473 counts/100 ml.

The new chlorination system, part of the Chlorination–Dechlorination Improvement Project, is currently in use. Since the new chlorination control system became operational in November 2011, King County has continued to evaluate and fine-tune the chlorination and dechlorination

controls at each discharge event. King County continues to monitor the performance of the new system and has made several improvements.

Total Residual Chlorine

During 2013, there were six discharge days out of nine that exceeded the maximum daily average effluent total residual chlorine (TRC) permit level of 104 µg/ml. These events occurred on March 19 (435 µg/L), March 20 (125 µg/L), April 6 (278 µg/L), September 5 (860 µg/L), September 6 (570 µg/L) and September 20 (390 µg/L).

The TRC exceedances may be caused by inadequate SBS mixing and the continual adjustments to the sodium bisulfite (SBS) feed in direct response to the minimum pH excursions (see below). The SBS feed may have been lowered below what was necessary for proper dechlorination on a few events. 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.

Carrier water volume may impact the mixing efficiencies. Currently, the water service to the Denny station, the location of dechlorination for the EWCSO treated effluent, is provided by a temporary connection. There is a capital project to bring in a direct city water service connection to Denny Station in order to increase the reliability of water service and increase water pressure for the station. Reliable water and higher water pressure is needed for two functions: As a source for SBS carrier water and water for back flushing sample pumps and lines. King County staff is continuously fine-tuning the chemical feed controls as well as monitoring the online chlorine analyzers and pH meter.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum and maximum effluent pH in 2013 was measured as 5.85 and 8.50, respectively. There were a total of nine discharge days in 2013, and six of those discharge days had the instantaneous minimum effluent pH measured below the 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 high pre-dechlorination chlorine residual requires additional SBS feed which in turn results in consumption of alkalinity. In response to these incidents of depressed effluent pH values, King County staff has been fine-tuning the SBS feed control program and reducing SBS feed and reducing hypochlorite feed; however, these actions did not prevent exceedances of the instantaneous minimum pH limit of 6.0 in subsequent discharges. Further analysis of the data trends of discharge events is ongoing.

Continuing the efforts from 2012, King County staff included supplemental alkalinity sampling of the wet well, pump discharge channel, pre-dechlorination sample, and final effluent sample streams. The alkalinities of the inflow and final effluents have been determined to be in the range 12-32 mg/L as $CaCO_3$. These very low alkalinity values are contributing to the pH challenges at Elliott West (EW). Staff also have been using a portable pH meter as an independent measurement throughout the treatment process, starting with the flows entering the wet well at EW, then pump discharge flows, pre-dechlorination, and final effluent. The inflows have a pH measurement around 7.0.

While the causes for the final effluent pH dropping below 6.0 have not yet been determined, significant time and effort has been and continues to be spent investigating the possible causes. King County staff will continue to respond to EW discharges in order to fine-tune the chlorination and dechlorination controls in an effort to prevent permit limit violations. Additional troubleshooting and the implementation of system improvements will occur in 2014.

Operation and Maintenance

Highlights of Operation and Maintenance activities at EWCSO during 2013:

- Conducted annual CSO refresher training for the operators in September 2013.
- Continued calling in a response team in anticipation of a treatment and discharge event. The team is comprised of an Instrumentation Technician, Operations staff, and a Process Analyst to troubleshoot and fine-tune the new chlorination-dechlorination feed controls, sampling and process control.
- Repaired and replaced the broken marine flap gate located in the outfall transition structure, completed November 2013.
- Switched to “Mode 3” of hypochlorite feed control, which is a feedback loop using the immediate chlorine residual (analyzer sampling from the pump discharge channel) as part of the control logic for the feed program.
- Implemented the automated Mercer Tunnel flushing program at the East Portal flushing gate in an attempt to flush and capture the solids settled in the Mercer Tunnel.
- 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 West Point Treatment Plant.
- Continued to conduct debriefings with operations and maintenance staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued to exercise the chemical feed pumps on a monthly basis as a preventive maintenance measure.

Chlorination-Dechlorination System Improvements Project

2013 marked the second year of operation for the new chlorination-dechlorination system controls, part of the Chlorination-Dechlorination System Improvement Project completed in November 2011. King County's response team was tasked with troubleshooting and fine-tuning the feed controls, and they have responded to each treatment and discharge event when the wet well was filling and 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 thereby reducing overfeeding of both hypochlorite and SBS. As a part of the fine-tuning effort, King County evaluated station performance during the operations debriefing held after each discharge event. This continuous improvement process is ongoing.

Final Effluent Sampling Improvements Project

The Final Effluent Sampling Improvements Project was completed in early 2013. This project will improve effluent sampling by minimizing the potential for seawater intrusion into the effluent sample stream. The project relocated the effluent sample intake from the outfall transition structure to the effluent pipe between the dechlorination and transition structures, upstream of the marine flap gate between the two structures. The project included a newly designed sample intake screen with a debris deflector designed to minimize debris that can clog the sample pump and line. Staff enters the pipeline and associated structures between events, and when safe, inspect the sample intake and evaluate the integrity of the sample and chemical feed lines. King County will continue to evaluate the effectiveness of the new effluent sampling system during each treatment and discharge event.

Near Future Operation

During Elliott West facility'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 this facility's design and operation and the "normal" challenges of an intermittently operated facility, King County has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons. King County staff will continue to fine-tune the chlorination-dechlorination controls and assess and improve the facility performance using these additional tools. In addition, King County staff responding to Elliott West CSO Treatment Plant will:

- Continue to investigate and correct the cause(s) of the instantaneous minimum pH limit exceedance.
- Continue to implement the response team to EW 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 newly completed Final Effluent Improvement Project.

- Complete the new city water service connection to the Denny Regulator and Pre-dechlorination station of EW scheduled to be completed by 2015. Due to project delays including obtaining access to railroad right-of way, this project timeline was revised, and a new schedule has been submitted.
- Implement a manual pumping strategy by the responding operators to manually control the main pump's speed to reduce pump acceleration and minimize the sudden ramping of flows through the treatment process. This strategy will be further evaluated and if possible, incorporated into the pumping control logic.
- Implement additional laboratory solids analysis 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 2013

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/L/hr)	EWCSO Effl. Settl Solids Event Max (avg) (ml/L/hr)	EWCSO Avg daily Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
January	8	1a	9.11	1a	7.40	2,802	2,359		2.50	-	40	0	5.85/6.20
	9	1b	18.35	1b	11.03	3,698	3,029		0.20	1.35	1	0	6.10/6.40
	10	1c	1.09	# ND	ND	318	21		ND	ND	ND	ND	ND
	20	2	0.21	ND	ND	182	9		ND	ND	ND	ND	ND
	23	3	0.37	ND	ND	256	11		ND	ND	ND	ND	ND
	27	4	0.21	ND	ND	102	6		ND	ND	ND	ND	ND
	29	5a	0.91	ND	ND	508	32		ND	ND	ND	ND	ND
	30	5b	0.35	ND	ND	99	14		ND	ND	ND	ND	ND
Instant. Min/Max pH													**5.85/6.40**
Event/Daily Max										**1.35**		**0**	
Monthly Total/Avg/Geomean		**5**	**30.60**	**1**	**18.43**	**7,965**	**5,480**	**31.2**			**6.3**		
February	No Inflow/No Disch.												
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**0**	**0**	**ND**	**ND**						**ND**		
March	2	1	0.49	ND	ND	175	6		ND	ND	ND	ND	ND
	19	2a	4.15	1a	1.38	2,958	2,689		2.00	-	40	435	6.34/8.00
	20	2b	14.71	1b	7.25	16,204	14,289		0.70	1.35	10	125	5.95/6.90
	21	2c	1.28	ND	ND	2,925	83		ND	ND	ND	ND	ND
Instant. Min/Max pH													**5.95/8.00**
Event/Daily Max										**1.35**		**435**	
Monthly Total/Avg/Geomean		**2**	**20.63**	**1**	**8.63**	**22,263**	**17,067**	**23.3**			**20**		
April	4	1	1.16	ND	ND	716	25		ND	ND	ND	ND	ND
	6	2a	2.16	1a	0.58	5,073	160		%NS	-	-	278	7.89/8.00
	7	2b	7.21	1b	4.62	837	450		0.07	0.07	70	50	5.93/8.00
	8	2c	0.95	ND	ND	238	7		ND	ND	ND	ND	ND
	13	3a	3.30	ND	ND	1,122	41		ND	ND	ND	ND	ND
	14	3b	1.92	ND	ND	224	15		ND	ND	ND	ND	ND

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/L/hr)	EWCSO Effl. Settl Solids Event Max (avg) (ml/L/hr)	EWCSO Avg daily Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	15	3c	1.00	ND	ND	892	24		ND	ND	ND	ND	ND
	18	4a	0.91	ND	ND	197	6		ND	ND	ND	ND	ND
	19	4b	1.78	ND	ND	520	24		ND	ND	ND	ND	ND
	20	4c	1.54	ND	ND	385	16		ND	ND	ND	ND	ND
Instant. Min/Max pH													**5.93/8.00**
Event/Daily Max										**0.07**		**278**	
Monthly Total/Avg/Geomean		**4**	**21.9**	**1**	**5.20**	**10,204**	**768**	**92.5**			**70**		
May	1	1	0.92	ND	ND	4,404	175		ND	ND	ND	ND	ND
	21	2	2.06	ND	ND	962	44		ND	ND	ND	ND	ND
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**2**	**2.98**	**ND**	**ND**	**5,366**	**220**	**95.91**			**ND**		
June	20	1a	5.30	ND	ND	5,860	446		ND	ND	ND	ND	ND
	21	1b	4.70	ND	ND	1,572	88		ND	ND	ND	ND	ND
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**1**	10.0	**ND**	**ND**	**7,431**	**534**	**92.8**			**ND**		
July	No Inflow/No Disch.												
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**0**	**0**	**ND**	**ND**	**0**	**0**				**ND**		
August	No Inflow/No Disch.												
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**0**	**0**	**ND**	**ND**	**0**	**0**				**ND**		
September	5	1a	23.0	1a	21.3	36,257	19,990		1.20	-	700	860	6.25/790
	6	1b	9.9	1b	2.8	4,306	1,931		2.50	1.85	-	570	6.23/7.20
	15	2	0.7	ND	ND	491	15		ND	ND	ND	ND	ND
	28	3a	20.5	2	13.3	12,911	10,699		0.00	0.00	1	390	6.13/8.50
	29	3b	4.4	ND	ND	1,181	118		ND	ND	ND	ND	ND

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/L/hr)	EWCSO Effl. Settl Solids Event Max (avg) (ml/L/hr)	EWCSO Avg daily Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
Instant. Min/Max pH													6.13/8.60
Event/Daily Max										1.85		860	
Monthly Total/Avg/Geomean		3	58.41	2	37.38	55,146	32,753	40.6			26		
October	2	1	2.10	ND	ND	439	19		ND	ND	ND	ND	ND
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**1**	**2.1**	**ND**	**ND**	**439**	**19**	**95.7**			**ND**		
November	2	1	1.13	ND	ND	151	15		ND	ND	ND	ND	ND
	6	2a	0.93	ND	ND	365	13		ND	ND	ND	ND	ND
	7	2b	1.31	ND	ND	229	46		ND	ND	ND	ND	ND
	18	3	3.38	ND	ND	1,145	95		ND	ND	ND	ND	ND
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**3**	**6.74**	**ND**	**ND**	**1,889**	**170**	**91.0**			**ND**		
December	No Inflow/No Disch.												
Instant. Min/Max pH													**ND**
Event/Daily Max										**ND**		**ND**	
Monthly Total/Avg/Geomean		**0**	**0**	**ND**	**ND**	**0**	**0**				**ND**		
Total		**21**	**153.39**	**5**	**69.64**	**110,704**	**57,009**						
Inst. pH Min/Max													**5.85/8.50**
Max (GEM, SS, TRC)										**1.85**	**70**	**860**	
Annual Average								**48.5%**		**1.16**	**31**		

Notes:

 # ND= No Discharge.

*** NR= Not Reported due to lab error.**

%NS= No sample collected

^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.

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total EWCSO TSS lbs-in	Total EWCSO TSS lbs Discharged	Annual Average EWCSO %TSS Recovery	Maximum of Event Averages Settleable Solids (ml/L/hr)	Annual Average Settleable Solids Concentration (ml/L/hr)	Maximum of Monthly Geomean EWCSO Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean EWCSO Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of EWCSO Effl. Res. Cl2 (ug/l)	Instant. Min/Max pH	Comments
Includes all events	**153.4**	**69.6**	**110,704**	**57,009**	**48.5%**	**1.85**	**1.16**	**70**	**31**	**860**	**5.85/ 8.50**	

Appendix F
Henderson/Norfolk CSO Control System
Annual Report

January–December 2013

This 2013 annual report summarizes the performance of King County's Henderson/Norfolk CSO treatment facilities. These CSO facilities came online in 2005. They operate under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

There were two filling events and no discharge events during calendar year 2013. The Henderson/Norfolk CSO Treatment Plant received a total inflow of 2.68 million gallons.

Season's Weather Conditions

A total of 25.93 inches of rain fell in calendar year 2013 as measured at Henderson Pump Station. The Seattle-Tacoma International Airport (Sea-Tac) recorded 32.6 inches for 2013 compared to the historical annual average measured at Sea-Tac of 37.6 inches (15 year average).

Permit Compliance

The Henderson/Norfolk facilities operated well in 2013. All permit performance conditions were met and total suspended solids (TSS) removal averaged 79.4%. See Table F-1.

Table F-1. Henderson/Norfolk CSO Permit Compliance Summary

Compliance Summary	Value/Outcome
Number of Inflow Events:	2
Total Inflow Volume (MG):	2.68
Number of Discharge Events:	0
Total Discharge Volume (MG):	0
Total Influent TSS (lbs):	1127
Total Discharge TSS from MLK + WP (lbs):	231
Overall TSS Removal (%):	79.4
Annual rainfall (inches):	25.9
Annual Average TSS Removal Limit Compliance:	Met
Monthly Event Max Settleable Solids Limit Compliance:	No Discharge
Annual Average Settleable Solids Limit Compliance:	No Discharge
Max Daily Residual Chlorine Limit Compliance:	No Discharge
Monthly Fecal Coliform Limit Compliance:	No Discharge

Routine Operation and Maintenance Activities

The equipment and facilities of the Henderson/Norfolk CSO treatment system were fully functioning and available during 2013. 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.

Table F-2. Henderson/Norfolk Annual Plant Performance 2013

									Effluent Settleable Solids			Effluent Chlorine		Effluent Fecal Coliforms		Effluent Max/Min pH	
Month	# of Inflow Events @ MLK	# of Discharge Events @ MLK	Inflow Vol. (MG)	Discharge Vol. (MG)	MLK Influent TSS (lbs)	MLK Effluent TSS+WP (lbs)	%TSS Removal (Monthly Ave Report)	Permit Limit for Annual Average %TSS Removal	Max. of all events in a month (ml/L/hr)	Permit Max. of all events in a month (ml/L/hr)	Permit Limit for Annual Avg (ml/L/hr)	Max. of Daily Averages (µg/l)	Permit Limit for Max of Daily Avg (µg/l)	Monthly Geomean (#/100 ml)	Permit Limit (#/100 ml)	Instant. Min/Max	Permit Limit for pH Min/Max
January	1	0	2.58	0	1097	230	79.0%			1.9			39		400	NA	**6.0/9.0**
February	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
March	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
April	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
May	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
June	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
July	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
August	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
September	1	0	0.10	0	30	1	95.1%			1.9			39		400	NA	**6.0/9.0**
October	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
November	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
December	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
Annual Total All Events	**2**	**0**	**2.68**	**0**	**1127**	**231**	**79.4%**	50%									