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July 27, 2017

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RE: King County 2016 Combined Sewer Overflow (CSO) Control Program Consolidated Annual Consent Decree and NPDES Report

Dear Sir/Madam:

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 CSO Control Program Consent Decree Annual Report, dated July 2017. The report addresses the County's CSO control project and compliance activities from January through December 2016.

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. This report documents CSO control program activities for calendar year 2016.

Previous reports are available on the County's CSO control program website at:
http://www.kingcounty.gov/services/environment/wastewater/cso/library/annual-reports.aspx

With the agreement of U.S. Environmental Protection Agency and Washington State Department of Ecology, this report responds to the reporting requirements of the Consent Decree (§ VIII, paragraph 43), 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).

Note that this Annual Report is for the 2016 calendar year. There is no information contained in this reporting responding to the incident at West Point Treatment Plant on February 9, 2017. Information on that incident is being reported to Ecology and EPA on a routine basis and will be summarized in 2018 through the 2017 Annual Report due to Ecology and EPA on July 31, 2018.

Thank you for your review of the King County 2016 Annual CSO and Consent Decree Report. If you have any questions or would like additional information, please contact me at 206-477-4601, or at Mark.Isaacson@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.

7-11-17

Mark Isaacson, Director
Wastewater Treatment Division
King County Department of Natural Resources and Parks

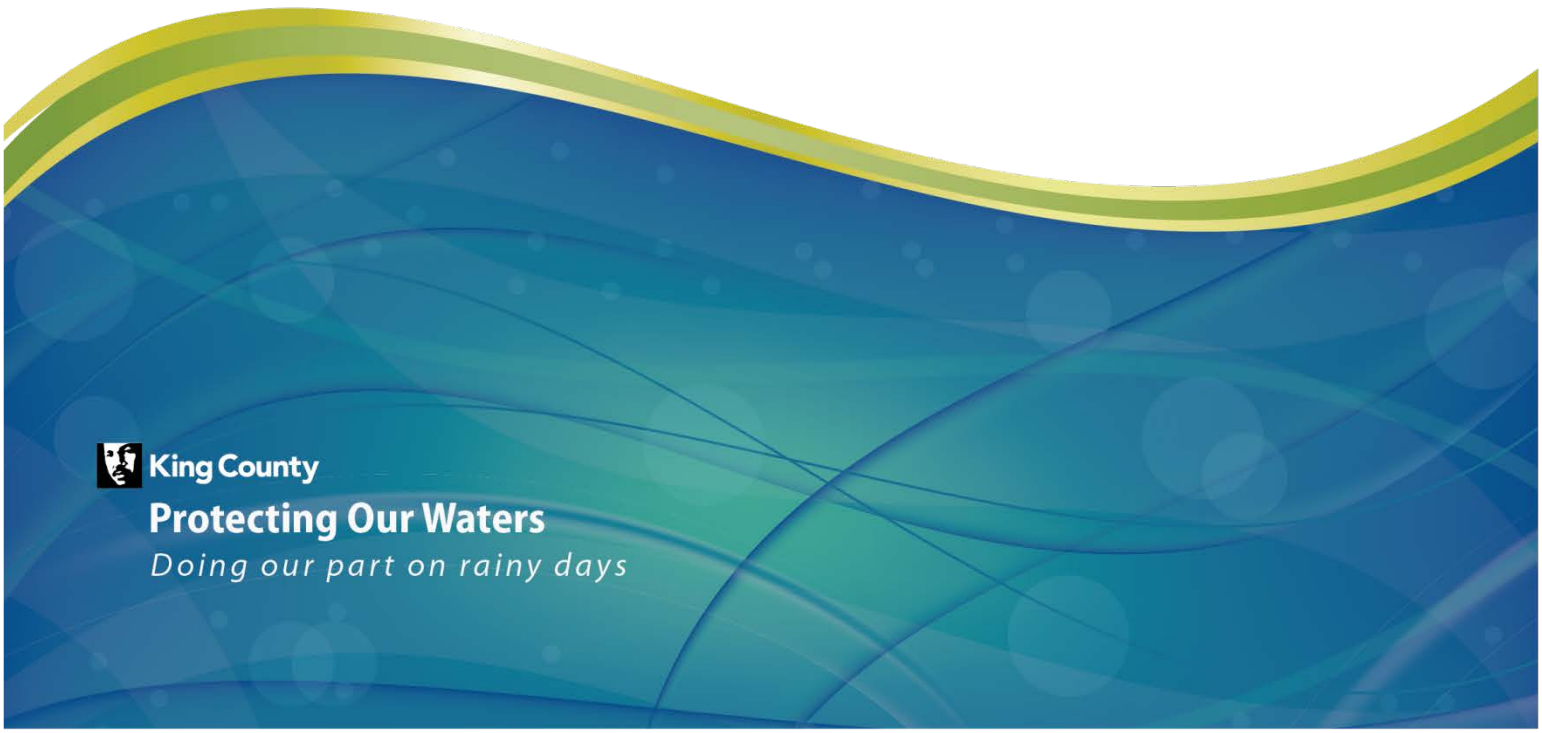
Date

cc: Verna Bromley, Senior Deputy Prosecuting Attorney, King County Prosecuting Attorney's Office
Jeff Lafer, Wastewater Planner/Project Manager IV, King County Department of Natural Resources and Parks (DNRP), Wastewater Treatment Division (WTD) Environmental and Community Resources Section
John Phillips, CSO Control Program Manager, DNRP, WTD, Project Planning and Development Section (PPD)
Eric Mandel, CSO Program Coordinator/Capital Project Manager IV, DNRP, WTD, PPD

Combined Sewer Overflow Control Program

2016 Annual CSO and Consent Decree Report

July 2017



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List of Abbreviations and Acronyms

BMP	Best Management Practices
CD	Consent Decree
Seattle	City of Seattle
County	King County
CSO	combined sewer overflow
DOJ	Department of Justice
DSN	Discharge Serial Number
DWO	dry weather overflow
EBI	Elliott Bay Interceptor
EPA	Environmental Protection Agency
FOG	fats, oil, and grease
GSI	green stormwater infrastructure
HLKK	Hanford/Lander/King/Kingdome
hr	hour
Joint Plan	Joint Operations and System Optimization Plan
JOIST	Joint Operations Information System Team
JPA	Joint Project Agreement
KCIWP	King County Industrial Waste Program
L	liter
LHWMP	Local Hazardous Waste Management Program
LTCP	Long-term Control Plan
Metro	Municipality of Metropolitan Seattle
MG	million gallons
MGD	million gallons per day
ml	milliliter
MLK	Martin Luther King
MOA	Memorandum of Agreement

WQA/MS	Water Quality Assessment/ Monitoring Study
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PCMP	Post Construction Monitoring Plan
PLC	programmable logic controller
PS	pump station
RS	regulator station
RWSP	Regional Wastewater Services Plan
SBS	sodium bisulfite
SCADA	Supervisory Control and Data Acquisition
SMP	sediment management plan
SPU	Seattle Public Utilities
SS	settleable solids
SSOP	Sewer System Operations Plan
SCIP	Source Control Implementation Plan
TRC	total residual chlorine
TSS	total suspended solids
TEPS	Tunnel Effluent Pump Station
UIC	underground injection control
WAC	Washington Administrative Code
WTD	Wastewater Treatment Division
WWTS	Wet Weather Treatment Station
VE	value engineering
VFD	variable frequency drive

1 Introduction

King County's (County) Wastewater Treatment Division (WTD) is responsible for managing the County's regional wastewater system, which consists of both separate and combined systems. WTD prepares annual reports for the combined portion of its system which includes its combined sewer overflow (CSO) control program. This annual report fulfills requirements under the National Pollutant Discharge Elimination System (NPDES) permit for the County's West Point Treatment Plant (WA0029181) in Seattle and requirements in Washington Administrative Code (WAC) 173-245-090. King County submits these reports to the Washington State Department of Ecology (Ecology). The most recent NPDES permit was issued for West Point Treatment Plant on December 19, 2014 and became effective on February 1, 2015.

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

CSO control is important to King County because CSOs are a recognized source of water pollution that can result in temporary increases in bacterial counts, aesthetic degradation of shorelines, long-term adverse impacts on sediment quality at discharge points, and raised public health concerns in areas where there is potential for human contact. Protection of water quality and compliance with environmental regulations are top priorities for King County.

In addition, the County is committed to meeting all the milestones and actions outlined in the CD. WTD staff are provided with ongoing trainings and briefings to ensure they are able to fully meet the required milestones and actions of the CD. WTD has a dedicated staff position to provide division-wide communication on the CD to ensure everyone works together to achieve these priorities.

This report documents King County CSO control program activities and information for the 2016 calendar year on the following topics:

- Implementation of early action and long-term CSO control plan measures.
- CSO volumes and frequency of overflows (including overflow durations and associated rainfall data).
- Information on any CSO-related bypasses at the West Point Treatment Plant.
- Information on any dry weather overflows (DWO).
- Sewer System Operations Plan (SSOP) implementation.
- Revision of the Joint Operations and System Optimization Plan (Joint Plan) between WTD and SPU based on comments from the Department of Ecology.
- Implementation of the Joint Operations and System Optimization Plan (Joint Plan) between WTD and Seattle Public Utilities (SPU).

- Coordination between WTD and SPU on CSO control projects.
- National Pollutant Discharge Elimination System (NPDES) permit compliance for the King County wet weather treatment stations (WWTS).
- Stormwater best management practices in partnership with SPU for their NPDES municipal stormwater permit.

Note that this Annual Report is for the 2016 calendar year. There is no information contained in this reporting responding to the incident at West Point Treatment Plant on February 9, 2017. Information on that incident is being reported to Ecology and EPA on a routine basis and will be summarized in 2018 through the 2017 Annual Report due to Ecology and EPA on July 31, 2018.

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

1.1 King County CSO System

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 (Seattle) local wastewater collection system contains combined sewers that collect both wastewater and stormwater. The newer local systems in the other 33 agencies served by WTD use separated sewers to convey wastewater and stormwater within different pipelines. Seattle's combined sewers convey flows to King County trunks and interceptors, which convey the majority of 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 County's South Treatment Plant in Renton. King County's responsibility for sewerage facilities begins at the point where 1,000 acres of drainage come together.

When large storms occur and flows exceed the capacity of the County conveyance system, CSOs may occur at any of the 39 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 may also occur at Seattle's 87 CSO locations in their local sewer system. SPU is responsible for separately managing and reporting on those locations.

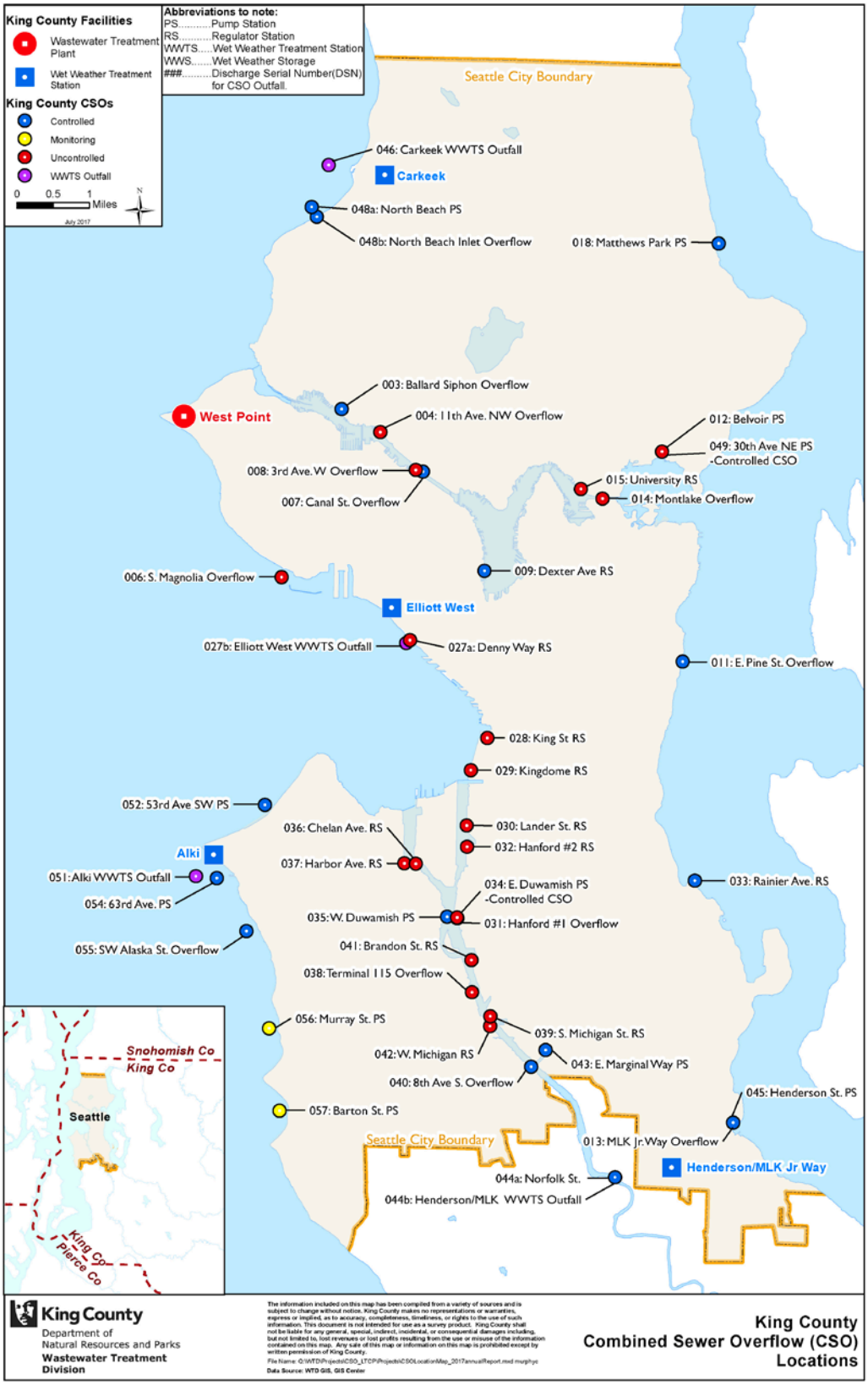

Figure 1. King County CSO Locations

1.2 CSO Control Plans, Amendments, and Updates

Since the 1970s, 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. Prior to each CSO Control Plan update, the County reviews the plan, progress toward CSO control, and its existing program against conditions that may have changed since the last update – conditions such as flow patterns, scientific developments, changed regulations, new technologies, and public priorities. Significant changes may require adjustment of the CSO Control Plan and potentially the CD.

1.2.1 CSO Control Plans, 1979-2012

Metro first formalized CSO control with the development of the 1979 CSO Control Program, which was developed in cooperation with EPA and 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 to meet this requirement.

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

King County took over responsibility for operating and maintaining the regional wastewater system from Metro 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 assessed the effectiveness of CSO reduction efforts to date, reevaluated priorities for control of CSO sites, and identified three control projects for completion between 1995 and 2000.

In the late 1990s, King County developed a major update to its comprehensive sewerage plan, including both the combined and separated systems, called the 1999 Regional Wastewater Services Plan (RWSP). During that period, Ecology agreed to discontinue the 75 percent 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 1995 Plan Update that consisted of 21 control projects to complete system control by 2030. The revision was included with the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application as the Year 2000 CSO Control Plan Update. 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 Elliott West Wet Weather Treatment Station (WWTS)/Mercer Street Treatment Tunnel and Henderson/Martin Luther King Jr. Way Wet Weather Treatment Station (Henderson/MLK Jr. Way WWTS) came online in spring 2005.

In the RWSP, the King County Council called for a review of the County's CSO control program ahead of the NPDES permit renewal application and update to the 2000 Plan Update 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 2008 CSO Control 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, control status of its CSOs and overall progress toward CSO control; how the County met the EPA's Nine Minimum Controls; and summarized the scientific studies that have shaped the control program over time. The 2008 Plan Update also described planned, in progress, and completed CSO control projects. No changes to the 1999 RWSP CSO Control Plan were recommended and King County committed to implementing the first four of the RWSP CSO projects — Barton St., Murray St., South Magnolia, and North Beach — together known as the Puget Sound Beach Projects.

In 2012, the County completed a three-year review of the CSO control program. The 2012 Long-term Control Plan Amendment (2012 LTCP) was approved by the King County Council in September 2012. The 2012 LTCP was submitted to Ecology and EPA on November 20, 2012, ahead of the June 2013 application date for the NPDES permit renewal and as part of the CD negotiations. The approved projects in the 2012 LTCP emerged from an evaluation of new conditions, opportunities, science, regulations, and community input since the last major CSO plan update in 1999. Project alternatives were developed for all uncontrolled CSOs to determine which were the most cost effective.

The approved 2012 LTCP is the County's current plan to construct nine projects to control 14 CSOs by the end of 2030. King County will conduct GSI early, ahead of traditional CSO control projects, for four projects, to reduce the size of the gray infrastructure needed to control CSOs.

The King County Council also approved a plan to complete a water quality assessment and monitoring study (WQA/MS) ahead of the next update of the LTCP. The purpose of the study was to ensure that future CSO projects to control pollution are well-planned and timed to improve water quality in the Elliott Bay, Duwamish River, and Ship Canal. The study was intended to confirm or identify possible adjustments in the sequence and schedule of future CSO projects, look at other planned water quality projects, and consider findings as part of a potential 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 water quality improvement programs in the region. The WQA/MS is discussed further in Section 1.2.3 Water Quality Assessment/Monitoring Study.

1.2.2 2018 Long-term Control Plan Update

In 2015, King County began a comprehensive update of the CSO control program and the 2012 LTCP approved in 2013. Every five years, updates are required by the WAC 173-245-090, West Point Treatment Plant's NPDES Permit, and King County Code 28.86.080. The resulting 2018 LTCP Update will be submitted to Ecology and EPA with the next West Point Treatment Plant NPDES permit renewal application, due January 2019.

In the 2018 LTCP Update, WTD will be conducting analyses of the remaining uncontrolled CSO locations (Figure 1) where projects are not already being implemented, including an evaluation of the CSO control projects identified in the 2012 LTCP and a comprehensive assessment of control measures for each uncontrolled CSO location. A significant amount of new modeling and flow information has been obtained since the 2012 LTCP was completed. This information, along with additional options for collaboration with SPU, will inform the 2018 LTCP Update. The comprehensive assessment of control measures is intended to be an extensive, innovative analysis that includes consideration of multi-basin and multiple control options. It will consider separation, GSI, and storage and treatment as well as collaborative or joint projects with SPU.

The 2018 LTCP Update will provide recommendations on any changes being considered to the 2012 LTCP and include refined cost estimates, schedule and project priorities, and sizing assumptions for recommended projects to address all uncontrolled CSO locations. The updated project recommendations, sizing assumptions, and costs will reflect environmental, social and equity, and financial goals to meet current needs, consider stakeholder interests, and implement the best approaches currently available to meet CD requirements. King County will continue to brief Ecology on the 2018 LTCP Update process so any potential changes to the 2012 LTCP will be discussed early in the process.

1.2.3 Water Quality Assessment/Monitoring Study

King County has been conducting a Water Quality Assessment/Monitoring Study (WQA/MS) as directed by King County Ordinance 17413, Section 2 that was approved in September 2012. The purpose of the study was to explore ways to optimize water quality improvements in waterbodies where the County is planning combined sewer overflow (CSO) control projects. Work began in 2013 with the primary objectives of generating information and recommendations for input to the 2018 LTCP Update. The WQA/MS includes a comprehensive scientific and technical analysis of the current water quality of the receiving waters where uncontrolled County CSOs discharge (Elliott Bay, Lake Union/Lake Washington Ship Canal, and the Duwamish River), projections of future conditions in these waters, and review of ongoing and planned activities by the County and others to improve water quality. King County is using this information to identify opportunities to lower the cost of implementing the CSO control plan, establish baseline conditions for post-construction monitoring of CSO control projects, inform the sequencing/schedule of the remaining projects, and inform a decision on whether to pursue a CSO Integrated Plan allowed under the CD.

The WQA/MS sets out to generate information that will help answer the following questions:

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

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

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

Element	Timeframe
Review and analyze existing scientific and technical data on impairments (defined as water quality-related concerns) in receiving waters where uncontrolled County CSOs discharge, the sources of impairments, and planned and potential corrective actions.	2013
Provide venues for stakeholders to be engaged throughout the process.	2013–2016
Conduct targeted data gathering and monitoring, as necessary, to fill identified gaps in scientific data on water quality in these receiving waters.	2014–2015
Analyze and summarize scientific and technical data collected in 2014-2015 and reviewed during the assessment. Analyze current and future loadings to the water bodies.	2015–2016
Produce technical reports and a synthesis report.	2017

An external Scientific and Technical Review Team was assembled to review methodology and results. A synthesis report will incorporate the results of the analyses, data gap studies, and additional assessments to evaluate how to maximize water quality benefits from CSO improvements. Depending on assessment findings, the King County Executive may choose to direct the formation of an Executive's Advisory Panel. However, at this time, the Executive is not planning to pursue an Advisory Panel.

In 2015, the project team completed the bulk of the scientific and technical analyses and held a series of briefings with Ecology and other stakeholders.

In 2016, the project team shared its findings about current and future pollution loadings to the water bodies with these groups.

In 2017, the team will be completing the reports summarizing the technical work and will complete the synthesis report, which will be the final report on the complete WQA/MS.

More information on the WQA/MS is available at:
http://www.kingcounty.gov/services/environment/wastewater/cso/projects/water-quality-study.aspx

1.3 Consent Decree

After King County Council approval of the 2012 LTCP, King County submitted the LTCP to Ecology and EPA for approval. EPA and Ecology approved the County's LTCP as meeting federal requirements on March 7, 2013. This approved version became the basis for settlement of ongoing negotiations with EPA, Ecology, and DOJ to finalize a negotiated CD between King County, EPA, and Ecology. The CD was formally filed in United States District Court on July 3, 2013.

The CD commits King County to implement the LTCP CSO capital projects specified in the 2012 LTCP within the timelines specified in the CD (and 2012 LTCP) as well as to complete several related plans. King County has made it a high priority to meet all CD milestones. To date, the County has met all past milestones, with one exception, and is currently on schedule to continue doing so with all future milestones. The exception is the South Magnolia Overflow project (or South Magnolia Wet Weather Storage project), which had completed construction and was operating correctly until an unexpected conveyance pipe break prevented flows from reaching the new facility. Details on this occurrence are provided in the South Magnolia project summary under Section 3.

Project summaries detailing 2016 progress, planned work in 2017, and their schedule of milestones can be found in Section 3 of this report.

In addition to specific CSO project implementation, the CD required several plans that are now completed or in progress. These plans include:

- Supplemental Compliance Plans submitted August 2013 for Dexter Avenue Regulator Station Overflow (Dexter Ave. RS Overflow), Denny Avenue Regulator Station Overflow (Denny Ave. RS Overflow), and Harbor Avenue Regulator Station Overflow (Harbor Ave. RS Overflow) (with an amendment to the Harbor Ave. RS Overflow Supplemental Compliance Plan submitted September 2013). The aforementioned discovery of the conveyance pipe break triggered the preparation of a new Supplemental Compliance Plan for the South Magnolia Overflow project (submitted January 30, 2017).
  - Dexter Ave. RS Overflow is controlled.
  - Denny Way RS Overflow and Harbor Ave. RS Overflow are not yet fully controlled as of December 31, 2016.
- The Sewer System Operations Plan, submitted September 2013. A letter approving the SSOP was received from Ecology on May 30, 2014 and from EPA on July 29, 2014. The next review is August 2017.
- The Final Joint Operations and System Optimization Plan (Joint Plan) with SPU was submitted to EPA and Ecology on February 10, 2016 (ahead of the CD deadline of March 1, 2016). Comments were received from the EPA and Ecology, and a final Joint Plan will be submitted in 2017. The CD requires periodic updates once the Final Plan is approved; this is next due in December 2019.

An overview of these plans is found in sections 3.2 and 3.3 of this report.

WTD proposed a non-material CD modification to Ecology and EPA (approved and filed by DOJ on October 25, 2016) for 3rd Avenue West Overflow (3rd Ave. W. Overflow) and 11th Avenue Northwest Overflow (11th Ave. NW Overflow). This modification allowed for the substitution of the Ship Canal Water Quality Project (Ship Canal Project, a proposed joint SPU/WTD project) as an alternative to individual projects for those CSO locations. The approved formal CD change was contingent upon the signature execution of a Joint Project Agreement (JPA) by both Seattle and King County, which occurred July 27, 2016.

1.4 Sediment Sampling and Analysis

In 1999, King County prepared a sediment management plan (SMP) for addressing contaminated sediment at County CSO locations. The County is finishing an update to that plan in 2017. As part of the update process, a predictive sediment contamination model for CSO discharges has been developed. Two supplemental rounds of sampling at CSO locations were used to calibrate and verify model performance. Sediment sampling results of the first round covering the following locations were provided to Ecology at the end of 2012:

- Barton Street Pump Station Overflow (Barton St. PS Overflow)
- Murray Street Pump Station Overflow (Murray St. PS Overflow)

- North Beach Pump Station Inlet Overflow/North Beach Pump Station Wet Well Overflow (North Beach PS Inlet Overflow/North Beach PS Wet Well Overflow)
- South Magnolia Overflow (S Magnolia Overflow)
- Chelan Avenue Regulator Station Overflow (Chelan Ave. RS Overflow)
- 53rd Avenue Southwest Pump Station Overflow (53rd Ave. SW PS Overflow)
- Brandon Street Regulator Station Overflow (Brandon St. RS Overflow)
- Montlake Regulator Station Overflow (Montlake RS Overflow)
- University Regulator Station Overflow (University RS Overflow)
- 3rd Ave. W Overflow.

Sediment results of the second set of sampling covering the following locations were submitted to Ecology in April 2014:

- Belvoir Pump Station Overflow (Belvoir PS Overflow)
- University RS Overflow (additional sampling)
- Chelan Ave. RS Overflow
- Murray St. PS Overflow
- North Beach PS Inlet Overflow/North Beach PS Wet Well Overflow
- S. Magnolia Overflow

These two sampling events also collected baseline conditions at Barton St. PS Overflow, Murray St. PS Overflow, North Beach PS Inlet Overflow/North Beach PS Wet Well Overflow, and S Magnolia Overflow for the post-construction monitoring requirement.

Sampling in the vicinity of the Ballard Siphon location was completed in 2015. These results represent controlled CSO sediment conditions for the post-construction monitoring requirement. A sediment data quality characterization report was provided to Ecology in December 2016 pursuant to the West Point Wastewater Treatment Plant NPDES Permit (§S13.B, p. 41).

In late 2016, a second round of sampling was conducted at Barton St. PS Overflow to document controlled CSO sediment conditions for the post-construction monitoring requirement.

A draft sediment modeling quality assurance project plan was provided to Ecology in December 2016 pursuant to the West Point NPDES Permit (§S13.B, p. 41) for specific Lake Washington CSO outfalls (i.e., 011, 012, 049, 013, 045, 018, and 033). The NPDES permit required characterization at these sites and the County's approved monitoring plan requires characterization by sampling or modeling.

1.5 Organization of this Report

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

- Report on implementation of EPAs Nine Minimum Controls (Section 2).

- Status of CSO control projects in design or construction (Section 3).
- Discussion of 2016 rainfall and untreated and treated CSO events (Section 4).
- Summary of Consent Decree violations in 2016 (Section 5).
- Table showing the 20-year average frequency of untreated CSO events (Section 6).
- Description of post-construction monitoring (Section 7).
- Detailed individual event-based tables for untreated CSOs in 2016 (Appendix A).
- Detailed individual event-based tables for treated CSOs in 2016 (Appendix B).
- Annual reports for the four satellite wet weather treatment stations: Alki Wet Weather Treatment Station (Alki WWTS), Carkeek Wet Weather Treatment Station (Carkeek WWTS), Elliott West WWTS, and Henderson/MLK Jr. Way WWTS (Appendices C through F).

This report meets the requirements of annual reporting as defined by the CD, WAC, and NPDES Permit. The crosswalks shown in Table 2 indicate where information meeting the requirements of each can be found in this report.

Table 2. Consent Decree, Washington Administrative Code, and National Pollutant Discharge Elimination System Permit Regulations Crosswalks

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

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

NPDES Permit WA0029181	Content	Annual Report Location
S11.C.2	The CSO Annual Report must include the following information: a. A summary of the number and volume of untreated discharge events per outfall for that year. b. A summary of the 20-year moving average number of untreated discharge events per outfall, calculated once annually. c. An event-based reporting form (provided by Ecology) for all CSO discharges for the reporting period, summarizing all data collected according to the monitoring schedule in Special Condition S11.B.9. d. An explanation of the previous year's CSO reduction accomplishments. e. A list of CSO reduction projects planned for the next year. f. A list of which permitted CSO outfalls can be categorized as meeting the one untreated discharge per year on a 20-year moving average performance standard. This annual assessment may be based on historical long-term discharge data, modeling, or other reasonable methods as approved by Ecology. The Permittee must submit paper and electronic copies of the report, and Excel spreadsheet copies of significant spreadsheets.	6.0 Twenty-year Moving Average of Event Frequencies Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B
S11.B	The Permittee must document compliance with the nine minimum controls in the annual CSO report as required in Special Condition S11.C.	2.0 Programs to Meet EPA's Nine Minimum controls
S11.F.b	The Permittee must report the running 20-year average number of overflow events per year during this permit term from these existing controlled CSO outfalls in the CSO Annual Report required in Section S11.C.	6.0 Twenty-Year Moving Average of Event Frequencies

2 Programs to Meet EPA's Nine Minimum Controls

The EPA's Nine Minimum Controls are actions that can be taken to minimize CSO impacts while long-term capital projects are under way. King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are a part of EPA's codified CSO Control Policy and included in the West Point Treatment Plant 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 2016.

2.1 Control 1—Reducing CSOs through Operation and Maintenance

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

Proper facility operation is managed by West Point Treatment Plant and South Treatment Plant staff using King County's Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides monitoring and control capabilities for the treatment plant collection systems. See Control 2 (Section 2.2) for information on King County's transition to a new SCADA system.

Under the Asset Management Program, 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 replace assets. The Asset Management Program, implemented by West Point Treatment Plant, South Treatment Plant, and conveyance inspection staff, ensures regular maintenance of CSO outfalls, regulator stations, and pump stations. Conveyance inspection staff inspects sewers on a specified schedule and perform corrective actions when deficiencies are found. Maintenance schedules and records of visits are available for inspection on request.

A review performed by King County in 2003 indicated that installing permanent backup generators in pump stations that lack reliable dual power feeds could help to prevent overflows. The installation process was completed when the last generator was installed at the Murray Street Pump Station (Murray St. PS) in December 2016.

2.1.1 Major Improvement Projects at Wet Weather Treatment Stations

The following operation and maintenance (O&M) activities have been implemented during 2016 at the wet weather treatment stations (WWTS) as part of the effort to improve operations. Wet weather treatment stations, referred to in the NPDES permit as CSO treatment plants, treat combined rain and wastewater that would otherwise have discharged to local waterbodies during rain events. These activities have been described to EPA and Ecology in regular

briefings provided by King County Operations and NPDES staff. More detail on WWTS O&M activities is available in the facility Annual Reports in Appendices C-F.

2.1.1.1 Alki WWTS

2.1.1.1.1 Completed Activities

- Conducted annual CSO refresher training for the operators in September 2016.
- Received shipments of both sodium hypochlorite and sodium bisulfite (SBS) treatment chemicals.
- Evaluated and made adjustments to the completed improvements to the influent sampling system.
- Cleaned out the effluent channel of accumulated solids and debris to improve solids removal and improve efficiency of the disinfection system.

2.1.1.1.2 Current and Future Activities

- Continue to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continue to evaluate and make any necessary adjustments to the dechlorination system as part of the Dechlorination System Improvement Project.
- Continue with the evaluation, testing, and adjustments of the new Variable Frequency Drives (VFD) for the 63rd Street pumps.
- Ongoing support of the project design for a hypochlorite feed system, including three new feed pumps and flow meters.
- Follow up and review consultant recommendations to improve Alki CSO treatment performance.

2.1.1.2 Carkeek WWTS

2.1.1.2.1 Completed Activities

- Conducted annual CSO refresher training for the operators in October 2016.
- Received shipments of both sodium hypochlorite and SBS treatment chemicals.
- Conducted debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Cleaned out the sedimentation tanks and effluent channel of accumulated solids and debris to improve solids removal and improve efficiency of the disinfection system.
- Performed quarterly testing of the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Performed a preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.

2.1.1.2.2 Current and Future Activities

- Continue to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continue to monitor and evaluated the completed flow measurement improvements
- Evaluation and adjustments to the recently installed VFD for pump set No.1 is ongoing.

2.1.1.3 Elliott West WWTS

2.1.1.3.1 Completed Activities

- Conducted annual CSO refresher training for the operators in August and September 2016.
- Utilized an on-site response team in anticipation of a treatment and discharge event, and during the event. The members of the multi-disciplinary response team worked together to troubleshoot and fine-tune the chlorination-dechlorination feed controls, sampling, and process control.
- Utilized the automated Mercer Tunnel flushing program at the East Portal flushing gate to flush and capture the solids settled in the Mercer Tunnel.
- Monitored the effectiveness of the automated Mercer Tunnel flushing by taking additional samples from the return flows and running laboratory solids analyses on the those samples.
- Operated the dewatering pumps during discharges in order to remove additional solids, to take advantage of the turbulence and re-suspension of solids in the wet well caused by the larger main pumps and increase the amount of solids in the return flows to the West Point Treatment Plant.
- Held regular debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and made any needed operational adjustments for subsequent events.
- Implemented additional procedures to the post-discharge event routines including equipment testing, cleaning, and de-ragging within the dechlorination and final effluent vaults/structures. Equipment includes both pre-dechlorination and final effluent sample pumps and sample intakes and SBS mixers.
- Performed quarterly testing of the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Made changes to main pump control program with the goal to minimize large pump flow swings impacting treatment and impacts to upstream conveyance.
- Implemented a project to design, install, and operate an inline SBS post-dilution system to dilute the 38 percent SBS to 20 percent solution. The SBS post-dilution system will be implemented by summer 2017.
- Implemented "semi-auto" mode for SBS feed control, which when engaged disables input from the pre-dechlorination chlorine analyzer to the SBS feed program during times when the analyzer is not working properly.

2.1.1.3.2 Current and Future Activities

- Continue to investigate and correct the cause(s) of the instantaneous minimum pH exceedances.
- Continue to implement use of the response team at Elliott West WWTS as the wet well fills and in anticipation of a discharge.
- Continue evaluation and fine-tuning of the chlorination and dechlorination controls.
- Implement a project to relocate instrumentation and sampling equipment into a separate room out of the SBS day tank room. Staff will continue to provide project support throughout the implementation, construction, and commissioning phases of the project.
- Continue to sample and monitor copper and dissolved oxygen of Elliott West WWTS flow per NPDES permit requirement. Additional work to evaluate copper sources in wastewater flows will be conducted through 2017 and 2018.
- Continue with laboratory solids analyses on all flows sampled as part of the monitoring of the automated Mercer Tunnel flushing program.
- New diffuser designed for SBS application will be installed in summer 2017. Evaluation of the diffuser will start shortly after installation.
- Implement the SBS post-dilution system by summer 2017 and fine tune as necessary.
- Continue evaluation and fine-tuning of changes in the main pump control program.

2.1.1.4 Henderson/MLK Jr. Way WWTS

2.1.1.4.1 Completed Activities

- Design of the following capital improvements to improve flow measurement accuracy was completed in 2016:
    - Re-level the tunnel influent and effluent weirs to match the design elevations and programmable logic controllers (PLC) programming.
    - Add fine-range bubbler sensors near the tunnel influent and effluent weirs, and add bubbler control panels.
    - Add chemical flow meters on the sodium hypochlorite and SBS discharge lines to directly measure chemical flow rates.
    - Modify pipe venting to allow the sodium hypochlorite line to drain freely and to eliminate gas binding at high points.
    - Install a bubbler access hatch at the Henderson/MLK Jr. Way Tunnel Outlet RS.

2.1.1.4.2 Current and Future Activities

- Construction of improvements designed in 2016 and listed above will begin in 2017.
- Design of the following capital improvements to improve chemical dosage control and building safety will begin in 2017:
    - Modify the sodium hypochlorite and SBS metering pumps.
    - Add a chlorine residual analyzer (with feed forward programming) upstream of the tunnel effluent overflow weirs.

- Modify the SBS chemical room exhaust duct if needed to improve building ventilation.

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. The sizing of the largest in-line tunnels are shown in Figure 2. Maximizing storage in the conveyance system works in concert with maximizing conveyance to the West Point Treatment Plant to minimize overflows and obtain high quality treatment for service area flows. The system has been built to operate as much as possible based on gravity flow and on levels in the interceptors and trunks, with little operator intervention.

When levels reach pre-determined set points, PLCs automatically adjust gates and pumps to manage the flows. These set points have been determined over the years by operational experience, hydraulic analysis, and modeling to balance conveyance to the treatment 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 treatment plant operators using monitoring systems that report data in independent communication pathways from the control system. Operators at West Point Treatment Plant's Main Control will remotely take control of certain facilities – primarily Interbay Pump Station (Interbay PS) to force storage in the Mercer Street Treatment Tunnel (Mercer St. Treatment Tunnel) and the West Seattle Pump Station (West Seattle PS) to force storage in the West Seattle Tunnel – to manage flows to and through the West Point Treatment Plant. The intent of this operations strategy is to avoid surges and oscillations in the plant 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. The Ovation control system upgrades are substantially complete, and the control system was up and running, before December 2016. Additional adjustments and fine-tuning will occur in early 2017.

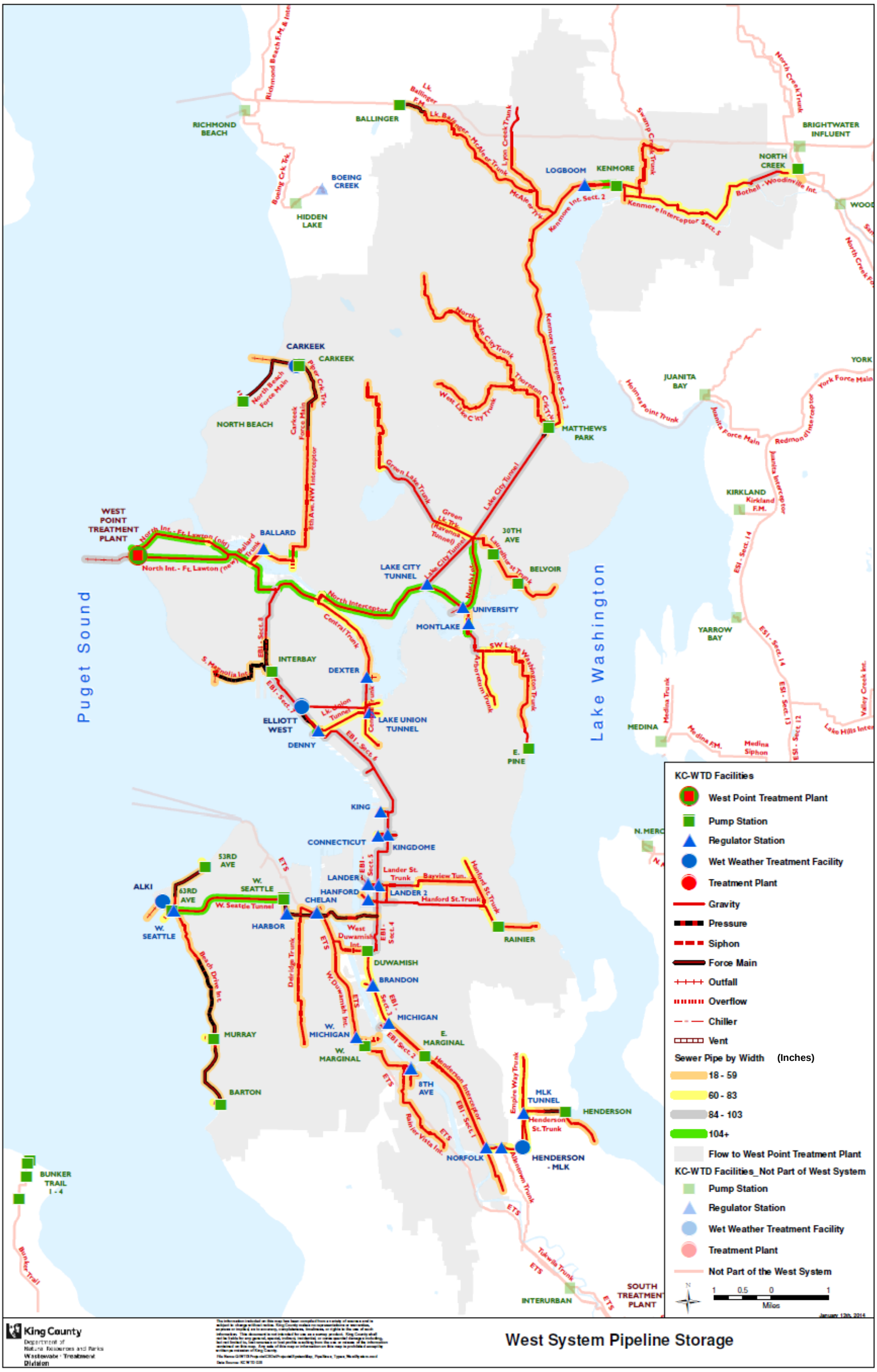

Figure 2. King County Wastewater West System Pipeline Storage

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

2.3 Control 3—Optimizing Pretreatment Program

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

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

Influent and effluent quality at the West Point Treatment Plant is assessed for trends that would suggest concurrent changes in CSO discharges. In addition, biosolids quality data from the West Point Treatment Plant are tracked as an indicator of changed loading to the system that could influence CSO quality. No specific new trends were observed in 2016 in pollutant concentrations. Biosolids concentrations are relatively stable and well below EPA's standards.

Beginning in 2016, WTD began to include the downstream CSO to which each permitted industrial discharger contributes in the annual Pretreatment Report submitted to Ecology.

King County is currently working with Ecology on the County's Source Control Implementation Plan (SCIP) for the Lower Duwamish Waterway. The first draft was submitted in June 2014. King County revised its SCIP based on comments received from Ecology on April 3, 2015. The revised plan was submitted to Ecology in March 2016. King County is currently implementing the plan, which covers 2014-2018. Another five-year SCIP will be developed to cover the next five years (2019-2023). Per the SCIP, King County submitted a Source Control Annual Report for years 2014-2015, documenting source control activities for that period. Source control annual reports will continue to be produced each year.

2.4 Control 4—Maximizing Flow to Treatment Plant

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

The 2014 SSOP describes how maximizing storage in the conveyance system works in concert with maximizing conveyance to the treatment plant to minimize CSOs and obtain high quality treatment for service area flows. As described in Control 2 (Section 2.2) and shown in Figure 2, the West System is essentially a deep in-line tunnel system that can convey a wide range of flows to the West Point Treatment Plant. SCADA is used to maximize flow to the secondary treatment plant, while protecting the biological treatment system, via operation of regulators and pump stations. The parallel Fort Lawton Tunnel was built in 1992 to convey up to 440 million gallons per day (MGD) to the West Point Treatment Plant. West Point Treatment Plant provides secondary treatment for all base flows (defined by Ecology as 2.25 times the average wet weather flow) and CSO/primary treatment for flows between 300 MGD and the designed instantaneous peak hydraulic capacity of 440 MGD. CSO/primary treated flows are mixed with secondary effluent for disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small reduction—80 percent instead of 85 percent removal during the wet season months of November through April—in total suspended solids (TSS) percent removal requirements.

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

Where captured CSOs cannot be conveyed to secondary treatment plants due to conveyance system limitations, flows are conveyed to WWTS. King County currently operates four wet weather treatment stations; Alki WWTS, Carkeek WWTS, Elliott West WWTS, and Henderson/MLK Jr. Way WWTS. The 2012 LTCP includes two additional facilities to maximize treatment: Georgetown Wet Weather Treatment Station (Georgetown WWTS) for the Brandon St. RS Overflow and South Michigan Street Regulator Station Overflow (S Michigan St. RS Overflow), and Hanford/Lander/ King/Kingdome Wet Weather Treatment Station (HLKK WWTS) for the Hanford #1/Lander Street Regulator Station (Lander St. RS)/King Street Regulator Station (King St. RS)/Kingdome Regulator Station (Kingdome RS).

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

2.5 Control 5—Preventing Dry Weather Overflows

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

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

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

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

Operation and maintenance programs, as described for Control 1 (Section 2.1), focus on DWOs and exacerbated CSOs. The conveyance system is monitored through SCADA and direct inspection, and corrective action is taken immediately if a problem occurs. Equipment problems are immediately reviewed and repair or replacement is undertaken in a timely manner.

2.6 Control 6—Controlling Solids and Floatables

Implement measures to control solid and floatable materials in CSOs.

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

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

- Capturing the "first flush" (maximizing flow to treatment plants) so that most solids and floatables that do enter the sewer are conveyed to the secondary treatment plants 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 SPU 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. SPU's catch basin maintenance program limits the introduction of floatable materials to sewers.
- Educating the public on keeping trash and grease out of the sewers http://www.kingcounty.gov/services/environment/wastewater/education/protect-environment/flush-trouble.aspx.
- Encouraging less water use to reduce unnecessary flows in the sewer that contribute to overflows http://www.kingcounty.gov/services/environment/wastewater/education/protect-environment/less-water.aspx.
- Monitoring the development of new floatables control technologies for future CSO control projects.

2.7 Control 7—Preventing Pollution

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

The NPDES permit (section S11.B) specifies that King County, starting with this Annual CSO Report submitted in 2017, must include a detailed description of the pollution prevention program, appropriate Best Management Practices (BMPs), and the legal authority and administrative procedures that will be used to ensure the program is being implemented. Additionally, permit provisions also state that if the legal authority and/or administrative procedures are not in place, the 2017 Annual CSO Report must include a detailed description of the steps needed to establish such a program and the timeline for getting the program in place.

The following section describes the programs that comprise King County's pollution prevention program to reduce sources of flows and contaminant loading within the combined basins. It also describes efforts in 2016 to coordinate with Seattle to ensure pollution prevention programs align, cover the geographic area fully, and are comprehensive in addressing all pollution types (solid waste, wastewater, stormwater, etc.). The section is divided into subsection that describes existing industrial and commercial programs, community programs and stormwater programs.

Programs to Support Industrial and Commercial Pollution Prevention

King County's Industrial Waste Program (KCIW), along with the County's Local Hazardous Waste Management Program (LHWMP), contributes to source control within the combined sewer system. KCIW serves to regulate industrial facilities throughout Seattle to reduce the discharge of chemicals and other substances to sanitary sewers including the combined sewer system that might adversely impact the environment and the wastewater treatment process. KCIW also manages construction dewatering permits within Seattle that propose to discharge wastewater to the sanitary sewer system. LHWMP provides outreach to smaller facilities through a non-regulatory business inspection program, which includes partial-reimbursement vouchers for purchase of source control equipment or services. The LHWMP is a multi-jurisdictional effort of King County, SPU, two tribal governments, and 37 local town and cities that is implemented through a "Management Coordination Committee", and enabled by the King County Board of Health. The LHWMP creates plans to manage hazardous wastes produced by households and in small quantities by businesses and other organizations. The LHWMP is funded by local hazardous waste fees on solid waste (garbage) and sewer accounts.

KCIW 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 KCIW 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 KCIW'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.

In addition, since 2014 King County has continued to implement the Source Control Implementation Plan (SCIP) for the Lower Duwamish. The Plan includes working with Lower Duwamish businesses and residents on pollution prevention as well as County performed studies and activities.

Programs to Support Community Pollution Prevention

King County and Seattle manage a number of general public education and outreach efforts, and specific waste collection/reduction programs, for the purpose of reducing contaminant discharges to the sanitary sewer and stormwater systems in combined basins (water conservation programs, Adopt-a-Road, Adopt-a-Street, recycling resources). Both KCIW and LHWMP maintain extensive online program information and availability of resources and events. The County's LHWMP manages free hazardous waste collection services for household and business wastes (mobile collection, hazardous waste collection/drop-off sites). The King County

Board of Health passed Secure Medicine Return regulation in 2013 (also known as the "drug take back" program) that generates tax revenues from pharmaceutical sales for the LHWMP to facilitate the collection and disposal of prescription and over-the-counter medicines at pharmacies and law enforcement offices at no cost to residents. King County and Seattle also collaborate on various campaigns including "Puget Sound Starts Here" and "Don't Drip and Drive" that provide free clinics to educate owners on how to inspect and repair automotive fluid leaks (e.g., oil and antifreeze). The agencies also promote proper pest waste disposal and Seattle maintains "Mutt Mitt" plastic bag stations throughout the city. Seattle also stencils facilities or posts other signs to prevent dumping or discharge of wastes in the storm drainage systems. Educational materials on controlling trash disposal to sewers are also addressed as part of the larger public information programs described in Control 6 (Section 2.6).

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

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

In 2016, the following grants were awarded through the King County WaterWorks competitive grant funding, funded and administered by WTD. Funding for these 11 projects totaled $850,000, not including administration, and all of them will have water quality benefits.

1. *Cascadia College: Student Led Solutions to Stormwater Pollution ($18,500).* This project engages students at Cascadia College in water quality monitoring to identify sources of pollution, such as fecal coliform, and design and implement stormwater best management practices to reduce the amount of pollutants entering the watershed.
2. *City of Kent: Leber Homestead - Arsenic Remediation ($100,000).* This project removes arsenic contaminated soil from the floodplain area on the Leber Homestead site in Kent. These contaminants are being removed and buried in order to prepare the site for salmon habitat restoration work of creating a floodplain wetland tributary to the Green River.
3. *City of Seattle, Seattle Public Utilities ($250,000).* This project is using in-stream data loggers to record temperatures and conductivity in the Thornton Creek Basin to help locate sewage sources. Once this methodology of using data loggers is fully tested, it can be used in other areas.
4. *Friends of the Issaquah Salmon Hatchery: FISH Volunteer Recruitment Support ($30,000).* This project includes the recruitment and training of new volunteers, including

Spanish-speaking volunteers to expand FISH's offerings in the community. This program will involve educating children and adults about the importance of protecting watersheds.

5. *Futurewise: Stormwater Pollution Reduction Project for Algona ($81,565).* This project works with community groups and teachers in the City of Algona on a variety of stewardship projects emphasizing the role that residents can play in reducing stormwater impacts. This project includes creating a toxics for teens program, planting trees, creating a pilot community garden, and creating educational signage at a wetland.
6. *King County Water and Land Resources Division: Duwamish Floating Wetlands ($154,986).* This project is evaluating the potential for using floating wetlands to enhance shorelines, improve water quality, and increase salmon habitat. Different types of floating wetlands are being tested, including commercial and custom designs.
7. *Mountains to Sound Greenway Trust: Me-Kwa-Mooks Park Community Engagement and Restoration ($50,000).* This project performs ecological restoration work at Me-Kwa-Mooks Park in West Seattle. Approximately three acres of invasive plants are being removed and restored with native plantings, engaging local school groups.
8. *Nature Vision: Water Quality Education Project ($24,949).* This project is teaching in-class programs and conducting field trips about water quality and wastewater to students at schools in the Green/Duwamish watershed. The focus is on place-based water quality education to students in low-income schools to help them become water stewards.
9. *Seattle Tilth Association: Improving Water Quality through Changes to Agriculture Practices ($50,000).* This project is conducting educational workshops and providing ongoing technical assistance at the Green River Farm in Kent, which is farmed by Hmong families, to help support the farm's transition from conventional to organic practices. Invasive plants are being removed and replaced with native species as a buffer for the farm's agricultural practices.
10. *Stewardship Partners: Green Stormwater Infrastructure Mini Grants and Community Engagement Campaign ($75,000).* This project is developing a small grant program for green stormwater infrastructure (GSI) on non-RainWise eligible private properties and launching a community engagement campaign across the WTD service area to increase public awareness of GSI.
11. *West Woodland Elementary School PTA: Rain Garden Restoration - Built to Last ($15,000).* This project is repairing and enhancing an existing rain garden at West Woodland Elementary School in the City of Seattle with the addition of fencing, pathway, bridge, and educational signage. Students and volunteers are helping with the installation, soil tests, and ongoing maintenance.

As part of the King County grant program, the Puget Sound Clean Air Agency settlement agreement (Notice and Order of Civil Penalty No. 12-020 CP Section III.C. February 23, 2012) 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 equally over the four-year period, with $104,670 allocated for each year. 2016 is the last year of the program. Over the four years that the grant program was active, a total of 23 projects were funded. For 2016, the projects and recipients are:

- *Green Solutions to Air Pollution ($45,000)*. This project will implement strategies to address sources of air pollution in Georgetown and South Park. Strategies will be selected from those identified as highly effective in a literature review (green walls, green billboards, and redesigning tree-planting methods). Strategies will be chosen and implemented in collaboration with the community, including mapping potential locations, engaging businesses, training interested community members, and collaborating with other opportunities.
- *Restoration of Wetland at 23rd Avenue SW and SW Findlay Street ($40,000)*. Delridge Neighborhood Development Association will lead a community effort to improve the water quality and hydrology of Longfellow Creek and its outfall into the West Waterway of the Duwamish River through the purchase and restoration of a 7,144 square foot wetland. The wetland is part of a 20,000 square foot parcel being surplused by Seattle City Light. The project will provide needed green infrastructure in a combined sewer overflow basin and an underserved neighborhood. It provides the opportunity to engage the surrounding community with hands-on science related to water quality and wetland restoration.
- *Green Infrastructure Job Corps: Growing Green Infrastructure Careers through On-the-Job Training ($15,980 and $37,000 from WTD Green Stormwater Infrastructure Program)*. This project provides a portion of the funding needed to organize and run three sessions of the "Green Infrastructure Job Corps" (fall 2015, winter 2016, and spring 2016). This program develops skills and career pathways for young adults 17 years and older to pursue green infrastructure design, construction, landscaping, or operations and maintenance careers. The grant pays stipends to participants and other funding (from direct invoicing to customers) will pay for technical support for small-scale green infrastructure projects in the Georgetown and South Park neighborhoods of Seattle. The program builds confidence in young adults through training and participating in a crew that assists with community-driven projects like tree-planting, wetland restoration, rain garden design and construction, maintaining existing GSI installations, and vegetation management.

Programs to Support Municipal Stormwater Management

In 2012, King County funded a three-year Source Control Inspector position within Ecology to conduct stormwater inspections in separated and combined basins of the Lower Duwamish Waterway. In 2016, King County used the findings from the inspections in the combined basins, supplemented by other source control information from the Lower Duwamish Waterway, to initiate discussions between King County and SPU on the nature and type of source control activities in combined basins that could have the greatest potential to influence CSO quality. This information furthered the discussion on the adequacy of source control activities and understanding legal authority to meet the NPDES permit.

In 2016, WTD worked with City of Seattle to understand the stormwater pollution prevention BMPs implemented within the City of Seattle that provide effective source control consistent with the provisions of each agency's NPDES permit. Because all of King County's CSO basins lie within the City's boundaries, the City's management and maintenance activities under their

jurisdictional authority for properties, facilities, and streets provide many of the source control actions commonly recognized as most effective for reducing contaminant discharges in CSO systems. Seattle provides area-wide services for solid waste collection, street sweeping, and stormwater system maintenance and catch basin cleaning. Both King County and Seattle maintain hotlines for reporting of illegal dumping; the County routes reports to the appropriate jurisdictional entity for cleanup of sites.

Seattle adopted an updated "City of Seattle Stormwater Manual" in January 2016 that includes a "Source Control" program (Volume 4), including several broad requirements applicable to "City-wide" properties (Chapter 2 requirements) and more specific requirements applicable only to separated flows (Chapter 3). The City of Seattle has the authority to implement mandatory BMP requirements under the source control program throughout the city in combined, separated, and partially separated areas as follows:

- *Illicit Connection Identification and Elimination.* Under this provision, sanitary side sewer systems must be inspected for illicit connections of sanitary or process wastewater flows. In addition, SPU and WTD also conduct inspections for illicit connections when they are suspected or determined to exist within a basin.
- *Routine Maintenance.* This program requires property owners to inspect, maintain, and periodically clean approved stormwater facilities such as collection, conveyance, catch basins, and treatment systems (e.g., oil/water separator), and properly dispose of wastes.
- *Proper Disposal of Fluids and Wastes.* Seattle requires all real property to implement proper liquid waste storage, disposal, and runoff prevention measures.
- *Proper Storage of Solid Wastes.* Seattle requires all real property to implement proper solid waste storage and disposal practices.
- *Spill Prevention and Cleanup.* This provision requires businesses and real properties that load, unload, store, or manage liquids or erodible materials (e.g., stockpiles) to maintain spill plans, equipment, and practices to prevent and clean spills, as well as notification procedures for spills to the drainage and sewer systems.
- *Provide Oversight and Training for Staff.* Businesses and public entities that have activities requiring BMPs are required to have trained personnel for their implementation.
- *Site Maintenance.* Businesses and public entities that involve materials or wastes that may come into contact with stormwater are required to implement proper housekeeping practices to minimize discharge of contaminants such as inspections, avoidance measures (containment, covering, or locating activities away from drainage systems), and sweeping and cleaning procedures.

Under the Seattle Stormwater Code, Seattle has the authority to require the minimum requirements covered under Ecology's Surface Water Design Manual for Western Washington. SPU has the authority to conduct business inspections for stormwater code compliance purposes in both separated and combined basins, and conducts catch basin inspection and cleaning. However, combined basin inspections are conducted on an infrequent basis compared to more regular inspections for basins regulated under the stormwater NPDES permit. In

addition, Seattle requires the use of GSI to the maximum extent feasible on all new projects. Finally, both WTD and SPU conduct stormwater drainage and sanitary sewer facility inspection and mapping programs to document the boundaries of separated, partially separated, and combined basins.

In reviewing the existing programs, described above, to provide source control in combined basins, both WTD and SPU have determined that existing legal authorities are sufficient to effectively administer and implement these programs. WTD and SPU recently decided to develop a MOA to facilitate tracking and reporting on the progress of source control actions that are implemented under the existing programs that fulfill the NPDES permit pollution prevention program and is developing a schedule for this MOA. WTD and SPU will continue to implement the pollution prevention program that is consistent with each agency's NPDES permits, and that benefits each agency's combined sewer system. Updates to this detailed description of the program's approach, appropriate BMPs, and the legal authority and administrative procedures that can support the program will be included in the both agencies' 2017 Annual Report.

2.8 Control 8—Notifying the Public

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

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

A website providing real-time notification of recent and current CSO discharges went live in December 2007 (http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx). In April 2011, King County completed the process to incorporate City of Seattle near real-time overflow information on this website. The website presents overflow status for the majority of Seattle and County CSOs with links to and from each agency's independent website. The community has access to consolidated information to assist in making choices about use of local waters. In late 2015, the website was upgraded to be more usable on mobile devices and allows users to zoom in and out to get more details. This upgrade "redesigned" the site from a set of five pages (an overview map and four submaps) to a single page map.

In 2016, the CSO Control Program and the CSO Status Web pages had 9,342 page views (representing 8,236 unique page views, with 86 percent of users viewing and then leaving the page (bounce rate)). Due to the timing of the redesign and the change in the number of pages available to view, page view counts cannot be compared between 2015 and 2016. The 2017 Annual Report will be able to compare percent change to 2016.

2.9 Control 9—Monitoring CSO Outfalls

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

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

In 1986, Metro began a sampling program to characterize each CSO and identify high priority sites for early control. The program included collecting overflow quality data for five CSO sites per year and collecting sediment samples at each site. In the 1990s, sampling was expanded to assess compliance with Washington State Sediment Management Standards. The County's extensive monitoring for its 1999 CSO Water Quality Assessment of the Duwamish River and Elliott Bay found that the majority of risks to people, wildlife, and aquatic life would not be reduced by removal of CSOs because most risk-related chemicals come from sources other than CSOs.

Under the previous NPDES permit for the West Point Treatment Plant effective July 1, 2009, King County developed a comprehensive sediment quality summary report for all CSO discharge locations (submitted December 2009). It can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/SedQuality/0912_CompSedQualSumRptCSODischargeLoc.pdf.

King County's Post-Construction Monitoring Plan (PCMP) is designed to assess, document, and report on the effectiveness of its CSO control program in achieving performance requirements and complying with state water and sediment quality standards. Also see Chapter 7 for additional information. The King County PCMP was submitted to Ecology in July 2010 and was approved on September 28, 2012. It can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/ProgramReview/2012/AppH_CSO_PostConstructionMonitoringPlan,Sept2012.pdf.

3 CSO Control Measures Currently Under Way

This section describes the progress made on implementing current CSO control projects and other projects that affect CSO control. It includes project specific summaries of progress made in 2016, planned activities for 2016, and where each project is in relation to its schedule of milestones.

The CD requires the County to report on projects under way and early action CSO control measures. The CD milestone statuses through 2016 are summarized in Table 3. The locations of the CSOs and the status of the related project(s) are included in Figure 3.

Table 3. Summary of King County Consent Decree Milestones through 2016

CSO Name (Project Name)	DSN	CD Milestone and Required Date	Actual Milestone Completion Date
Barton St. Pump Station (Barton Street Roadside Raingardens)	057	Construction Completion by December 2016 CSO controlled by December 31, 2017	Construction Completed December 2016
Ballard Siphon Regulator[1] (Ballard Siphon Project)	003	CSO outfall controlled by December 31, 2014	Outfall Controlled December 2014
Chelan Ave. Regulator Station (Project Name TBD)	036	Submit Facility Plan by December 31, 2018	N/A
Brandon St. Regulator Station/ S. Michigan St. Regulator Station (Georgetown Wet Weather Treatment Station)	039, 041	Submit Facility Plan by December 31, 2015 Completion of Bidding by December 31, 2017	Facility Plan Submitted November 2015
Hanford #2 Regulator Station/ Lander St. Regulator Station/ King St. Regulator Station/ Kingdome Regulator Station (Project Name TBD)	032 030 028 029	Submit Facility Plan by December 31, 2024	N/A
Montlake Regulator Station (Project Name TBD)	014	Submit Facility Plan by December 31, 2023	N/A
Murray Street Pump Station (Murray St. Wet Weather Storage Project)	056	Construction Completion by December 31, 2016 CSO controlled by December 31, 2017	Construction Completed November 2016

CSO Name (Project Name)	DSN	CD Milestone and Required Date	Actual Milestone Completion Date
North Beach Pump Station (North Beach Wet Weather Storage Project)	048a, 048b	CSO outfall controlled by December 31, 2016	Outfall Controlled December 2016
Hanford #1 (Rainier Valley Wet Weather Storage Project)	031	Completion of bidding by December 31, 2016 Construction Completion by December 31, 2019	Completed Bidding May 2016
11th Ave NW/ 3rd Ave W (Ship Canal Water Quality Project)[2]	004, 008	Submit Draft Facilities Plan/Engineering Report by March 31, 2017	Draft Facilities Plan submitted January 2016
South Magnolia (S Magnolia Wet Weather Storage Project)[3]	006	CSO controlled by December 31, 2016 Supplemental Compliance Plan due January 30, 2017	Supplemental Compliance Plan submitted January 27, 2017
University Regulator Station (Project Name TBD)	015	Submit Facility Plan by December 31, 2023	N/A
West Michigan St. Regulator/ Terminal 115 (West Duwamish CSO Control Project)	038, 042	Submit Facility Plan by December 31, 2020	N/A
Dexter Ave. Regulator Station (Dexter Ave. Supplemental Compliance Plan)	009	Submit to Ecology & EPA within 30 days of CD (July 3, 2013)	Supplemental Compliance Plan submitted August 2013; Compliance achieved July 2016
Denny Way Regulator Station (Denny Way Supplemental Compliance Plan)	027a	Submit to Ecology & EPA within 30 days of CD (July 3, 2013) Revised Plan submitted to Ecology August 31, 2016 Completion of modification by December 2018	Supplemental Compliance Plan submitted August 2013; Revised Plan submitted August 2016
Harbor Ave. Regulator Station (Harbor Ave. Supplemental Compliance Plan)	037	Submit to Ecology & EPA within 30 days of CD (July 3, 2013) Revised Plan submitted to Ecology August 31, 2016 Completion of modification by December 2018	Supplemental Compliance Plan submitted August 2013; Revised Plan submitted August 2016

Notes:

[1] As documented in the December 30, 2013 notification to DOE and EPA, the portion of the project required to control the Ballard CSO was completed, though other portions of the project under construction (i.e. slip lining the existing siphon barrels) were outstanding and needed before the contract substantial completion could be issued.

[2] Per October 25, 2016 Non-Material CD Modification. CD Appendix A refers to two stand-alone CSO outfalls, East Ballard (a.k.a. 11th Ave. NW) and 3rd Ave. W and Ewing St (a.k.a. 3rd Ave. NW). The referenced CD modification allows these two outfalls to be controlled as part of the Ship Canal Water Quality Project in collaboration with the City of Seattle. SPU CD milestones will be used to measure progress since SPU is the project lead and their dates are earlier than the County's SCWQP dates for a joint project in the nonmaterial CD modification.

[3] CD Appendix A refers to this as Magnolia Overflow. Because this project did not meet its performance standard due to a pipeline breakage, the CD required Supplemental Compliance Plan was submitted. See project specific update on page 48.

Figure 3. King County CSO Control Projects

3.1 Project Summaries

A summary project status page for each active project follows. These project summaries do not include past completed projects or upcoming projects.

Projects in progress include:

- Barton Roadside Raingardens
- Murray Wet Weather Storage
- Georgetown Wet Weather Treatment Station
- Rainier Valley Wet Weather Storage
- Ship Canal Water Quality Project

CD/CSO Report Project Status
Barton St. Roadside Raingardens

CSO(s): DSN 057 (Barton St. PS Overflow)
Project Description: Construct green stormwater infrastructure (bioretention swales and associated drainage structures) and underground injection control (UIC) wells for CSO control. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonCSO-GSI.aspx.

Milestones	CD Milestone Date (Actual Date)	2010	2011	2012	2013	2014	2015	2016	2017
Submission of Facilities Plan	N/A (final 9/20/2011)								
Submission of Final Plans & Specifications	12/31/2012 (6/13/2013)								
Start of Construction	12/31/2013 (10/21/2013)								
Construction Completion	12/31/2016 (3/22/2016)								
Achievement of Performance Standard	12/31/2017 (expected 2017)								

2016 Accomplishments:
- KC staff fully took over monitoring compliance with the UIC well inspections from the contractor.

2016 Challenges and Corrections:
- Some of the plants grew more vigorously than expected and outgrew the allotted space. Landscape and Maintenance staff worked out the issues as they arose through trimming, changing the plant type, or removing the plant.
- There was some confusion at West Point about directing hotline issues; citizens occasionally contacted community relations staff in order to get a response. Reminders were given verbally and in fliers to the staff so the community information process would be followed.

2017 Activities in Progress or Expected:
- Continue project performance monitoring for compliance.

CD/CSO Report Project Status
Georgetown Wet Weather Treatment Station

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

Milestones	CD Milestone Date (Actual Date)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Submission of Facilities Plan	12/31/2015 (draft submitted 11/2/2015)											
Completion of Bidding	12/31/2017 (N/A)											
Construction Completion	12/31/2022 (N/A)											
Achievement of Performance Standard	12/31/2024 (N/A)											

2016 Accomplishments:

- Acquired three of four properties required for the Treatment Station site and relocated all but one business. Received Use and Possession of the final property; date set for 3/1/2017.
- Upon completing predesign, the project established its baseline scope, schedule, and budget.
- Expert Review Panel completed independent reviews of the project through 30 percent design.
- Hired a construction management consultant who provided constructability reviews and will provide construction management services during construction.
- Conducted submittal review activities with the two major equipment vendors: Suez (County contract) and Kruger (sole-source specified equipment) for UV disinfection.
- The project's Facility Plan was approved by Ecology on 8/5/2016.
- Amended the design contract to include design work through Notice-to-Proceed for each of the four construction contracts detailed below.
- Completed design for the Demolition, Remediation, and Site Preparation contract.
- Completed design through 90 percent for the Treatment Station and Conveyance contracts and through 60 percent for the Outfall contract.
- Conducted geotechnical field investigations and survey work, which will continue through early 2017.

- Began/continued permitting processes for major permits, including the Construction and United States Army Corp Section 404/10 permits.
- Continued community briefings and Design Advisory Group meetings.

2016 Challenges and Corrections:

- Anticipated full condemnation required for property acquisition for the treatment station and business relocation. In the end, all parties agreed to mediation and settlement agreement.

2017 Activities in Progress or Expected:

- Complete acquisition and business relocation for the final property required for the Treatment Station and related settlement agreements.
- Complete acquisition of remaining temporary and permanent easements required for the pipeline.
- Complete the work under the Demolition, Remediation, and Site Preparation Contract before the end of 2017.
- Complete design and permitting and advertise the Treatment Station contract and issue Notice to Proceed by the end of 2017 (Consent Decree milestone).
- Complete design and permitting and advertise the Outfall contract by the end of 2017.
- Continue geotechnical field investigations and survey work through early 2017.
- Complete permitting processes for major permits, including the Construction and United States Army Corp Section 404/10 permits.
- Continue community briefings.

CD/CSO Report Project Status
Murray Street Wet Weather Storage

CSO(s): DSN 056 (Murray St. PS Overflow)
Project Description: Construct wet weather storage. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/MurrayCSOStorage.aspx.

Milestones	CD Milestone Date (Actual Date)	2010	2011	2012	2013	2014	2015	2016	2017
Submission of Facilities Plan	N/A (final 9/30/2011)								
Submission of Final Plans & Specifications	12/31/2012 (12/31/2012)								
Start of Construction	12/31/2013 (10/16/2013)								
Construction Completion	12/31/2016 (11/14/2016)								
Achievement of Performance Standard	12/31/2017 (N/A)								

2016 Accomplishments:
- Substantial completion of construction achieved November 2016.

2016 Challenges and Corrections:
- Substantial completion was delayed from original contract finish, but CD milestone was still met.
- Weather caused 11 working days of delays.

2017 Activities in Progress or Expected:
- Artist to complete remaining project art.
- Landscape and restoration activities to be completed.
- Project performance monitoring for compliance.

CD/CSO Report Project Status
Rainier Valley Wet Weather Storage

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

Milestones	CD Milestone Date (Actual Date)	2013	2014	2015	2016	2017	2018	2019	2020
Submission of Facilities Plan	12/31/2014 (draft 2/28/2014)								
Completion of Bidding	12/31/2016 (5/16/2016)								
Construction Completion	12/31/2019 (N/A)								
Achievement of Performance Standard	12/31/2020 (N/A)								

2016 Accomplishments:

- Notice to Proceed occurred 5/16/2016.
- Finished excavation of the CSO tank.
- Finished excavation of the inlet siphon and discharge structures.
- Successfully completed microtunnel under Rainier Avenue for the siphon installation.

2016 Challenges and Corrections:

- Weather caused 11 working days delays.
- Permitting with Seattle caused a 66-day extension on the construction contract.
- The project is on track to meet the CD schedule.

2017 Activities in Progress or Expected:

- Concrete work for the CSO tank and the siphon inlet structure will occur.
- Pipe installation under Hanford Street will be completed.
- An auger bore will be drilled parallel to Hanford for another section of the pipe that will connect the CSO tank to the Hanford Tunnel.
- Bayview siphon construction will be completed by July 2017.

CD/CSO Report Project Status
Ship Canal Water Quality Project

CSO(s): DSN 004 (3rd Ave. W Overflow) and DSN 008 (11th Ave. NW Overflow)
Project Description: Offline storage in a deep storage tunnel on the north side of the Ship Canal to control SPU Ballard (Outfalls 150, 151 and 152), Fremont (Outfall 174), and Wallingford CSO basins (Outfall 147) and King County 3rd Ave. W Overflow (DSN 008) and 11th Ave. NW Overflow (DSN 004). Seattle Public Utilities is the lead agency for design and construction, and will own, operate, and maintain the tunnel and its related structures. WTD is coordinating with SPU on the project through a Joint Project Agreement approved by Seattle and County Councils in July 2016. The Joint Project Agreement will guide implementation, operation, and cost-sharing of the Ship Canal Project. The County is providing funding and technical expertise, and participates in the Joint Oversight and Project Review, and Change Management Committees. This project is in both King County and the City of Seattle's Consent Decrees. For more information see:
http://www.seattle.gov/util/EnvironmentConservation/Projects/ShipCanalWaterQuality/index.htm

Milestones	CD Milestone Date (Actual Date)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Submission of Draft Facilities Plan	3/31/2017 (1/15/2016)*												
Completion of Bidding	7/1/2021 (expected 2019)												
Construction Completion	12/31/2025 (N/A)												
Achievement of Performance Standard	12/31/2026 (N/A)												

Note: CD Milestones and Actual Dates are SPU's except for Construction Completion which is the same for both agencies. WTD's CD does not have interim milestones for a joint city-county storage tunnel.
*The formal County submittal date was 1/22/2016.

2016 Accomplishments

- Prepared draft Facility Plan and submitted on behalf of SPU and WTD in January 2016.
- SPU issued a draft Ship Canal Project Supplemental Environmental Impact Statement for public comment on September 22, 2016 and held a public hearing on October 18, 2016.
- In mid-2016, completed 30 percent design of the Storage Tunnel, Tunnel Effluent Pump Station (TEPS), and 3rd Ave W and 11th Ave NW Conveyance packages.
- Completed Value Engineering (VE) for the Storage Tunnel and TEPS.
- Completed Storage Tunnel 60 percent design in late 2016, incorporating VE results.

- In late 2016, completed 30 percent design of the Fremont Conveyance package.
- Completed 90 percent design of the Ballard Early Works Package, which includes Ballard site remediation, replacement of the pedestrian pier at the 24th Ave. NW street end, and temporary power and utility relocations at the Ballard site.
- Continued to acquire property needed for tunnel construction in Ballard and Wallingford.
- Continued with community outreach.
- DOJ, EPA, and Ecology approved a modification to King County's Consent Decree to allow this joint project. The Non-Material Modification (Civil Action no. 2:13-cv-677, Document 7) was filed with the United States District Court on October 25, 2016.

2016 Challenges and Corrections:

- Tunnel design has been advancing simultaneous with incorporation of updated rainfall and hydraulic data. To keep design work moving forward, sizing for minimum and maximum tunnel diameter (14 to 18 feet) has continued.
- The City of Seattle announced a routing for the Burke Gilman trail "missing link" in Ballard that will be sighted directly above the project's alignment. To minimize disruption in the neighborhood, some Ballard work will be re-sequenced.

2017 Activities in progress or expected:

- Selection of a final tunnel diameter size based on updated basin and system integrated models.
- Final Facility Plan and Final Supplemental Environmental Impact Statement will be submitted to EPA and Ecology in spring 2017.
- TEPS VE results will be incorporated in the TEPS 60 percent design, scheduled for completion in 2017.
- Complete 60 percent design of the Fremont Conveyance package.
- Construct Ballard Early Works Package in 2017 and 2018, in advance of tunnel construction.
- Obtain necessary property easements along the tunnel alignment. Properties are being appraised and easements are expected to be finalized in 2017 and 2018.
- Conduct 2017 outreach activities.

3.2 Supplemental Plan Summaries

A status page for each project under a Supplemental Compliance Plan follows.

Projects with active Supplemental Compliance Plans include:

- Denny Way
- Harbor Ave.
- S. Magnolia

CD/CSO Report Supplemental Compliance Plan Status
Denny Way Regulator Station Overflow

CSO(s): DSN 027a (Denny Way RS Overflow)
Project Description: Adjust facilities built in 2005 to achieve final control per the Supplemental Compliance Plan included in the 2011 TM 970, and updated to Ecology and EPA in 2012. Investigation suggested that two of the inputs—Denny Local and Denny Lake Union—were overflowing more than intended. The investigation recommended removal of the lower Denny local weir and modification of the Elliott West pump ramp-up strategy to drop the lead pump start set point by 2.25 feet and improve flow into the Elliott West facility. The weir modifications were completed in July 2011 and pumping strategy modifications were completed on November 17, 2011. Additional work on the pumping strategy was completed in the fall of 2015. Monitoring in 2016 still showed control issues with Denny Way and additional adjustments to pumping strategy were made in December 2016.

2016 Activities:

- Submitted Supplemental Compliance Plan to Ecology August 31, 2016.
- Developed consultant scope of work to model pumping strategy at Elliott West.

2016 Challenges and Corrections:

- Modifications identified in 2012 Supplemental Compliance Plan did not control CSO. Additional work will be done in 2017 and 2018.

2017 Activities in Progress or Expected:

- Since compliance was not achieved by December 31, 2015, Denny Way Basin will be included in the alternative analysis being performed in the 2018 LTCP Update to determine a compliance strategy.

CD/CSO Report Supplemental Compliance Plan Status
Harbor Avenue Regulator Station Overflow

CSO(s): DSN 037 (Harbor Ave. RS Overflow)
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 still available. Locking the gate partly open (51 percent) was recommended. Revised modeling of the regulator station found the CSO gate was not opening fast enough to control CSOs. Engineering assessment recommended replacing gate actuator to speed up gate operation.

2016 Activities:

- Performed analysis of the CSO gate and found a deficiency in the speed the gate opens.
- Completed preliminary design of new gate actuator to open gate faster.
- Completed a Supplemental Compliance Plan and submitted to Ecology and EPA on August 31, 2016.

2016 Challenges and Corrections:

- CSO did not meet compliance in 2016. Correction in progress.

2017 Activities in Progress or Expected:

- Since compliance was not achieved by December 31, 2015, Harbor Ave. RS Overflow will be included in the alternative analysis being performed in the 2018 LTCP Update to determine a compliance strategy.

CD/CSO Report Supplemental Compliance Plan Status
South Magnolia Wet Weather Storage

CSO(s): DSN 006 (S. Magnolia Overflow)
Project Description: Investigate solution to pipe break in the CSO conveyance pipe that was first discovered in fall 2016. A Supplemental Compliance Plan will be submitted in January 2017 to comply with the CD deadline for notifications. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/SMagnoliaCSOStorage.aspx.

Milestones	CD Milestone Date (Actual Date)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Submission of Facilities Plan	N/A (final 9/30/2011)											
Submission of Final Plans & Specifications	12/31/2012 (12/31/2012)											
Start of Construction	12/31/2013 (12/16/2013)											
Construction Completion	12/31/2015 (12/31/2015)											
Achievement of Performance Standard	12/31/2016 (N/A)											

2016 Accomplishments:

- The South Magnolia CSO Control System was constructed and in operation since December 2015.
- Monitoring of the facilities occurred throughout 2016.
- Submitted final change orders to Ecology.

2016 Challenges and Corrections:

- Settled dispute with Contractor via mediation for the storage facility.
- CSO did not meet compliance in 2016. County Operation staff confirmed there was a pipe break in the CSO conveyance pipeline after it became apparent that the storage tank was not in use during significant storm events in September and October 2016. Ecology was notified of the problem. Development of a Supplemental Compliance Plan began.
- Pipeline break was not located as of December 31, 2016.

2017 Activities in Progress or Expected:

- Submit Supplemental Compliance Plan (submitted on 1/27/2017).
- An addendum to the Supplemental Compliance Plan will be submitted separately from this CD/CSO Annual Report once the pipeline break is more fully assessed and a repair method is determined.
- Finalize as-built drawings for the constructed storage facility.
- Submit State Revolving Fund documents to Ecology for the project.
- Implement pipe repair solution. The County is also developing a plan to work with and notify the Community once a solution has been determined.

3.3 Program Plan Summaries

The CD required development and implementation of two plans: the Sewer System Operations Plan (SSOP) and the Joint Operations and System Optimization Plan (Joint Plan) with the City of Seattle.

3.3.1 Sewer System Operations Plan

WTD submitted the SSOP on September 27, 2013. Ecology and EPA approved the SSOP on May 29, 2014 and July 29, 2014, respectively. The SSOP is an electronic, interactive document with imbedded links to the most current base documents, such as O&M manuals, plant manuals, safety plans, and maps. King County staff typically access the SSOP from the County's intranet site. Portable storage device (thumb drive) versions are also provided at each facility and to key staff for access in the field or from home. Once a year in August, the team representatives of Operations, Offsite, and CSO control planning go over the plan to ensure that the electronic links still work. Every third year (beginning in 2017), the team will review the SSOP to ensure that base documents are being updated as needed and that any new or changed information is reflected in the SSOP. Thumb drives are replaced as needed.

3.3.2 Joint Operations and System Optimization Plan

Seattle's and King County's CDs direct both agencies to work together to develop a single Joint Plan. Staff from WTD and SPU focused on areas in the system that have the greatest potential for operational optimization and developed a set of multi-basin joint commitments. These commitments were approved by the Directors of SPU's Drainage and Wastewater Line of Business and WTD and were included in the Joint Plan, submitted to EPA and Ecology on February 10, 2016. Comments were received from EPA and Ecology and a revised plan will be submitted in March 2017. The following describe each commitment and the progress SPU and DRNP made in 2016:

- The Joint System Debrief Committee commitment is to evaluate performance of the SPU and WTD systems, identify interconnections to improve operations, and share information after major storm events. SPU and WTD conducted a post-storm debrief meeting on February 9, 2016 to review the operation of each agency's system during two major storm events occurring in November and December of 2015. A pre-season preparation meeting was held on October 6, 2016 to discuss maintenance activities, system changes, meteorological information, and interagency communications to be better coordinated for the 2016/2017 wet season.
- The Data Sharing commitment is supported by four activities: the formation of the Joint Operations Information Sharing Team (JOIST), implementation of a pilot project for sharing real-time SCADA data, development of data sharing protocols, and the improvement of regional ability to forecast storms and rainfall intensities.
    - JOIST held three meetings (March, June, and October 2016) during which SPU and WTD staff shared information on the operation of existing facilities, progress

of capital projects, and coordination of Joint Plan commitments, and conducted tours of both SPU and WTD facilities.

- The SPU and WTD Data Sharing committee developed standard operating procedures for sharing information. The first annual data review workshop was held in June to review flow monitoring data collected by each agency and provide recommendations for future monitoring.
- A Real-Time Data Sharing Pilot established a framework for real-time data sharing and resulted in development of a secure connection between WTD's and SPU's Supervisory Control and Data Acquisition (SCADA) systems for the Windermere/University basin where both WTD and SPU have pump stations and CSO control facilities. SPU and WTD are committed to allowing the pilot project to continue for three more years to test the protocols and improve data communications and quality while the agencies work on a permanent solution. In August, both agencies signed a Memorandum of Agreement (MOA) to conduct options analysis on an expanded platform for permanent joint operational real-time data sharing. This analysis was initiated with a project kick-off in November. When complete, the expanded platform will replace the pilot project.
- To move toward improved rainfall data collection for forecasting with additional gauges, WTD and SPU met with the Regional Modeling Consortium to discuss ways to support upgrades to the regional weather forecasting model. In addition, SPU and WTD are working together on analyzing climate change models led by the University of Washington Climate Impacts Group to better understand future impacts of intense rainfall on the wastewater systems. A portion of this work is funded by a grant from the Department of Ecology.
- SPU and WTD exchanged internal operational weather forecasts, rain gage data, and impacts information for the past few years. Staff shared post-storm analyses that led to the identification of hourly rainfall thresholds, which are currently being incorporated into weather modeling and forecasting. Through SPU's membership in the Northwest Regional Modeling Consortium, SPU and WTD are co-developing forecast alerts that will enable advanced operational adjustments to mitigate CSO and flooding events.

- The Joint Modeling Coordination Committee commitment is to share tools and modeled information to improve operational strategies. Members of the Joint Modeling Coordination Committee held five meetings in 2016 to review modeling results and coordinate model developments between each agency. A major work activity in progress is the development of a MIKE URBAN model of the North Interceptor system that combines elements of SPU's system with WTD's regional system.
- The Coordination during Startup and Commissioning of CSO Control Facilities commitment is to conduct document review, attend commissioning meetings, and implement data sharing during startup, commissioning, and ongoing operations at SPU and WTD CSO control facilities. In 2016, WTD reviewed the construction plans for the Leschi Phase 2 improvements, 14th and Concord Improvements Project, and North Union Bay retrofit. SPU also hosted facility tours for WTD staff.

- The Real Time CSO Notification commitment is to improve both onsite (signs) and website information to improve communication to the public about CSO events. In 2015, SPU and WTD updated the CSO notification website with a more dynamic interface. CSO overflow data is now updated on an hourly basis.
- The Reduce Saltwater Intrusion commitment is continuing to work together on studies, data sharing, and solutions for reducing intrusion. In 2016, WTD measured saltwater in their system during king tide events and is currently evaluating that data. The results will be shared between agencies in 2017.

3.3.3 WTD Coordination with SPU on CSO Control Projects

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

Projects completed prior to 2016:

- Delridge – NPDES 168 and 169: construction completed in November 2015 with flows to the regional system in November 2015.
- Genesee – NPDES 40/41 and 43: construction complete in early 2015 with flows to the regional system in January 2015.
- South Henderson – NPDES 46: construction completed in December 2015 with flows to the regional system in December 2015.
- South Henderson – NPDES 47B/171: construction completed August 2015 with flows to the regional system in August 2015.
- South Henderson – NPDES 47C: construction completed October 2013 with flows to the regional system in December 2013.
- Windermere – NPDES 13 and 15: construction completed in July 2015 with flows to the regional system in March 2015 (flows started during commissioning).

Projects completed in 2016:

- Leschi – NPDES 26 through 36: Phase 2 construction completed in August 2016 with flows to the regional system in 2016.
- North Union Bay – NPDES 18: construction completed July 2016 with flows to the regional system in 2016.
- South Park (14th and Concord): construction completed in August 2016 with flows to the regional system in 2016.

King County has been modeling flows from Seattle to the 30th Avenue Northeast (30th Ave. NE) and Belvoir Basins and determined that past SPU sewer system modifications from 2003 have been contributing additional flows to the regional system. WTD has identified Belvoir Pump Station as out of compliance as of the issuing of this 2016 Annual Report. WTD and the City of Seattle are working together to address the impacts to the regional system from these past sewer system improvement flow increases as well as from recent improvements in the North Union Bay and Windermere Basins.

WTD and City of Seattle have monitoring in place for those Seattle projects with potential to impact the regional system. WTD will continue working with SPU on control and operational strategies as Seattle starts up and continues operating Genesee, Delridge, North Union Bay, Leschi, South Park, Windermere, and the remaining components of the Henderson projects.

SPU and WTD continue to work together to ensure GSI projects in the City of Seattle use a consistent approach, per the GSI Memorandum of Agreement (MOA) signed by the two agencies in 2013. The term GSI describes a variety of measures that use soil to absorb stormwater or slow the rate of stormwater entering the combined sewer system. GSI solutions control the sources of pollution by slowing, detaining, or retaining stormwater so that it does not carry runoff into nearby waterways. GSI projects reduce the volume and timing of flows into the combined sewer system. GSI facilities also are referred to as natural drainage systems and can be a component of low impact development. Collaborative work between WTD and SPU in 2016 included:

- Extending the RainWise MOA to 2018.
- Integrating multiple web resources into a single internet site: http://www.700milliongallons.org/.
- Improving the calculated performance of rainwater harvesting as part of the RainWise Program.
- Completing design concepts for types of curbless roadways.
- Completing standards for installation of permeable pavement in roadways.
- Incorporating lessons learned from SPU and WTD projects to improve future projects.

Lastly, SPU and WTD are working closely on the Ship Canal Water Quality Project, a joint project that will control WTD's 11th Ave. NW and 3rd Ave. W. CSOs. The status of this joint project is described in Section 3.1 of this report.

4 Summary of Rainfall and CSO Events

King County measures rainfall in the Seattle area at many of its regulator stations, pump stations, overflow locations, and at the West Point Treatment Plant. It also monitors the frequencies and volumes of both untreated and treated CSOs at all of its permitted CSO locations.

This section describes rainfall data, reports on unpermitted overflows, and summarizes frequency and volume for all untreated and treated CSO discharges in 2016. Additional information can be found in the Appendices.

4.1 Annual Rainfall

Rainfall data is reported for each CSO event as measured by the nearest King County-owned rain gauge. Rainfall data for 2016 are included in Appendices A and B. The annual rainfall for 2016, as an average over local rain gauges, was 42.10 inches. The annual rainfall at Sea-Tac Airport was 45.18 inches, higher than the 20-year Sea-Tac Airport annual average of 37.49 inches. This was the third year in a row that was wetter than average. October rainfall of 10.05 inches set a monthly record. January was the second wettest month at 7.45 inches.

Long-term, WTD needs to look at how storms over the last 20 years may compare to storms of the next 20 years. Ecology and WTD are funding work at the University of Washington Climate Impacts Group to examine the next century of precipitation.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures, broken pipelines, and manholes. Unpermitted overflows can be of three types: dry weather overflows, exacerbated CSOs, or sanitary sewer overflows. Overflows in the combined system to CSO outfalls that occur beyond 24 hours after rainfall has ceased are called dry weather overflows (DWO). In King County's system, when DWOs occur, they usually result from mechanical failures, power outages, or human error. Under EPA's Nine Minimum Controls, DWOs are to be prevented. Overflows in controlled or uncontrolled basins to CSO outfalls that are increased or extended in duration as a result of mechanical failures, power outages, or human error, are referred to as "exacerbated CSOs." The release of sanitary or combined flows at any location in the conveyance system other than the designated CSO outfalls, regardless of the basin's "control" status, presence/absence of precipitation or existing high flow events, or causes due to mechanical failures, power outages, or human error, are referred to as sanitary sewer overflows (SSO). Additionally, the CD defines an SSO as "any overflow, spill, diversion, or release of wastewater from or caused by the Sanitary Sewer System or the Combined Sewer System" to surface waters of the state or United States, or to land. However, it is not considered an SSO when a wastewater release

occurs on land where the overflow is completely contained in a system designed for the purpose of wastewater containment during construction activity.

In 2016, no exacerbated CSOs, four DWOs at CSO outfalls, and one SSOs occurred in the County system, which are described in Table 4.

Table 4. Summary of Unpermitted Overflows in 2016

Date of Event	Facility	Description of Violation(s)
1/8/16	West Point Treatment Plant	DWO: gate operation failure; 810,000 gallons to Puget Sound
1/21/16	63rd Pump Station	SSO: Pipe leak; 14,000 gallons overland to Puget Sound
1/30/16	Henderson Pump Station	DWO: Power failure and generator failed to operate automatically, 18,000 gallons to Lower Duwamish River
7/12/16	Hanford #2 Regulator Station	DWO: Level sensor failure; 88,900 gallons to East Waterway
11/22 – 12/31/16	West Point Treatment Plant	DWO: gate seal leak; 9.4 MG to Puget Sound

4.3 Annual Untreated CSO Events

West Point Treatment Plant's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at 12 CSO locations not currently monitored by SCADA or to supplement SCADA monitoring: 11th Ave. NW Overflow, 30th Ave. NE Overflow, Southwest Alaska Street Overflow (SW Alaska St. Overflow), Bayview North Overflow (Bayview N Overflow), Bayview South Overflow (Bayview S Overflow), East Duwamish Pump Station Overflow (E Duwamish PS Overflow), W Duwamish Overflow, Hanford @ Rainier Overflow, S Magnolia Overflow, Murray PS Overflow, North Beach PS Inlet Overflow, and Terminal 115 Overflow. At Murray PS, the portable flow meter was removed at the end of 2016 when the wet weather storage project was completed and the upstream weir was blocked.

Hydraulic modeling predicts that King County CSOs will discharge 800 million gallons (MG) of untreated CSO in an average year of rainfall. In 2016, there were 32 storm events resulting in untreated CSO discharges. Some storm events spanned multiple days and, at times, there were multiple discharges on the same day. Conditions in 2016 resulted in 227 untreated CSO events discharging 1,064 MG and 45 treated CSO events discharging 407 MG. This is about a 30 percent higher volume than the 800 MG predicted during a normal rainfall year. The highest

precipitation occurred in October (10.05 inches) and resulted in 56 untreated events and 321 MG. The second highest precipitation occurred in January (7.45 inches), resulting in 49 untreated events, but a higher overflow volume of 370 MG than October.

During review of the 2016 events, King County determined that the overflow calculation for North Beach Pump Station was overestimating overflow volumes since construction of the storage facility and the calculation did not take into consideration the outfall capacity as affected by tide. The overflow calculation has been adjusted for 2016 and the volume for the January 21-22, 2016 North Beach event lowered from the previously reported 2.54 MG to 2.22 MG. The adjusted calculation will be used from this point forward.

Appendix A lists the untreated events from County CSOs during 2016. These data are also provided in electronic form to Ecology with this report.

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, Elliott West, and Henderson/MLK Jr. Way WWTSs.

The following sections summarize performance and compliance at each facility during 2016. Appendix B of this report provides more detail on volumes and events. Appendices C-F contain the annual reports for each wet weather treatment station.

4.4.1 West Point Treatment Plant CSO-related Events

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 treatment for flows above 300 MGD and up to a designed instantaneous peak of 440 MGD. Where captured CSOs cannot be conveyed to secondary treatment plants due to conveyance system limitations, flows are conveyed to wet weather treatment stations or are discharged untreated. CSO treatment at West Point consists of blending primary treated flows (between 300-440 MGD) with full secondary treated flows (up to 300 MGD), followed by disinfection, dechlorination, and discharge of the final effluent 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 of TSS during the typical wet season months of November through April. This practice is accepted by Ecology, provides a high level of treatment to CSO flows, and reduces program costs and impact to local waterbodies. The West Point Treatment Plant had 21 CSO-related events during 2016. The total volume was 407 MG. All occurrences are listed in Appendix B.

Dry weather secondary diversions can occur via CSO gates at West Point in the event of power and equipment failures, when necessary to prevent exposure of workers to safety hazards and facility damage. These secondary diversions receive primary treatment and disinfection

(including dechlorination). In 2016, there were two dry weather secondary diversions due to equipment failure-related incidences as noted in Table 4. Summary of Unpermitted Overflows in 2016. In the first instance, a short electrical power outage to the plant in January 2016 was followed by a control circuit failure that prevented operators from being able to restart the Intermediate Pump Station, subsequently resulting in the need for secondary diversion. Electrical repairs restored the Intermediate Pump Station control circuit, and pumping and full treatment capacity was restored after about 2 hours. In the second instance, during a total of 19 days from November 22 through the end of 2016, a total of 9.4 MG of secondary diversion flows occurred as a result of a leaking seal in one of the diversion gates. The leaking gate flow was contained and routed within the plant during this period to generally avoid the need for secondary diversions on dry weather days. The secondary diversion events primarily occurred during wet weather days, many of which included contribution of routine secondary diversion operations on days when plant inflows exceeded 300 MG. The gate seal repair was completed on January 15, 2017. Both incidents were report to Ecology as required.

4.4.2 Alki Wet Weather Treatment Station

The transfer of Alki area base flows to the West Point Treatment Plant was completed in 1998 and conversion of the Alki Treatment Plant from a continuously operating primary plant to a WWTS was completed in 2001. In 2016, there were ten filling events and six discharge events. The Alki WWTS received a total inflow of 91.3 MG and discharged 70.0 MG.

Overall, TSS removal was 42.8 percent for the year, which did not meet the annual 50 percent TSS removal limit. The annual average settleable solids (SS) was 0.09 milliliter per liter per hour (ml/L/hr), which met the SS limit of 0.3 ml/L/hr. The Alki WWTS met all remaining NPDES permit limits with the exception of one exceedance of the daily total residual chlorine limit and one monthly fecal coliform geomean limit. More detail is available in Appendix C.

4.4.3 Carkeek Wet Weather Treatment Station

The transfer of Carkeek area base flows to the West Point Treatment Plant and the conversion of the Carkeek Treatment Plant from a continuously operating primary plant to a WWTS was completed in 1994. In 2016, Carkeek WWTS had 17 filling events and eight discharge events. The Carkeek WWTS had a total inflow volume of 23.4 million gallons (MG) and discharged 17.7 MG.

Overall, TSS percent removal was 49.4 percent for the year thereby not meeting the NPDES permit limit of 50 percent for annual removal. Carkeek WWTS met its annual average SS limit with the average measured as 0.09 ml/L/hr with the NPDES permit limit being 0.3 ml/L/hr. All remaining NPDES permit limits were met with the exception of one daily total residual chlorine limit. More detail is available in Appendix D.

4.4.4 Elliott West Wet Weather Treatment Station

The Elliott West WWTS was brought online in May 2005 as a joint project with Seattle's East Lake Union CSO control projects. In 2016, there were 42 inflow events totaling 449.4 MG and

nine discharge events totaling 172.5 MG. Over 60 percent of the total discharged CSO volume occurred in October 2016.

Overall, TSS removal was 52.8 percent for the year, thereby meeting the NPDES 50 percent annual average TSS removal limit. However, Elliott West WWTS did not meet the SS annual event average limit with the average measured as 2.23 ml/L/hr with the NPDES permit limit being 0.3 ml/L/hr. Most NPDES permit limits were met with the exception of eleven daily total residual chlorine limit, one monthly fecal coliform geomean limit, and eight daily pH minimum limits. Elliott West WWTS performance limitations are being addressed through an assessment report (to be completed in 2019) and a resulting improvement project (to be completed by 2027). More detail can be found in Appendix E.

4.4.5 Henderson/MLK Jr. Way Wet Weather Treatment Station

The Henderson/MLK Jr. Way WWTS was brought online in May 2005. The Henderson/MLK Jr. Way WWTS had four filling events and no discharge events during 2016. The Henderson/MLK Jr. Way WWTS received a total inflow of 3.30 MG and discharged 0 MG of treated water through the Norfolk Street Overflow to the Duwamish Waterway. All NPDES permit performance conditions were met. More detail is available in Appendix F.

5 Summary of Consent Decree and NPDES Violations in 2016

Section VIII. 43 of the CD requires the listing of any violations of the CD in the Annual Report. Table 5 identifies CD violations in 2016 and related exceedances of related NPDES wet-weather permit requirements for the CSO system. Detail on causes and corrective actions are provided in Appendices C-F. All notifications to Ecology were made in a timely manner.

Table 5. Summary of Effluent Limitation* and Consent Decree Violations in 2016

Date of Event	Facility	Description of Violation(s)
1/21/16	Elliott West WWTS	total chlorine residual
1/21/16	Elliott West WWTS	pH
1/21/16	63rd PS Overflow	SSO overland due to pipe leak
1/27/16	Elliott West WWTS	total chlorine residual
1/27/16	Elliott West WWTS	pH
1/30/16	Henderson PS Overflow	DWO due to power failure and generator failed to operate automatically
2/11/16	Elliott West WWTS	pH
2/12/16	Elliott West WWTS	total chlorine residual
2/12/16	Elliott West WWTS	pH
3/9/16	Elliott West WWTS	total chlorine residual
7/12/16	Hanford #2 Regulator Station	DWO due to flow meter mechanical failure
10/13/16	Alki WWTS	total chlorine residual
10/13/16	Elliott West WWTS	total chlorine residual
10/14/16	Elliott West WWTS	total chlorine residual
10/19/16	Elliott West WWTS	total chlorine residual
10/19/16	Elliott West WWTS	pH
10/20/16	Elliott West WWTS	total chlorine residual
10/20/16	Elliott West WWTS	pH
10/26/16	Elliott West WWTS	total chlorine residual
October	Alki WWTS	Fecal coliform monthly geomean
October	Elliott West WWTS	Fecal coliform monthly geomean
11/14/16	Elliott West WWTS	total chlorine residual
11/14/16	Elliott West WWTS	pH
11/24/16	Carkeek WWTS	total chlorine residual
11/24/16	Elliott West WWTS	total chlorine residual

11/24/16	Elliott West WWTS	pH
2016 annual	Alki WWTS	Annual average TSS removal
2016 annual	Carkeek WWTS	Annual average TSS removal
2016 annual	Elliott West WWTS	Annual average settleable solids

* pH effluent limits are specified in the NPDES permit, but are not specified as violations subject to stipulated penalties under the CD.

6 Twenty-Year Moving Average of Event Frequencies

The NPDES permit for the West Point Treatment Plant, effective July 1, 2009, implemented a new interpretation of the performance standard for CSO control, which is derived from the Washington state regulatory requirements for "greatest reasonable reduction" as specified in WAC 173-245-022(22). The CD recognizes this performance level. This standard of "not more than one untreated discharge event per year per outfall on average" is based on a 20-year moving average. The number of untreated discharges that occurred over each of the previous 20 years is reported for each CSO site and then averaged (Table 6). This moving average is used each year to assess compliance with the performance standard. However, since the upgraded SCADA system was fully brought online in 2005 and began to report data for all sites over time, a full 20 years of data are not available for all sites. Locations lacking the full 20 years of measured data are noted. For sites where new control facilities have been built and, thus, lack the 20 years of measured data, modeled data of how the new facilities would have performed with the historic rainfall over those years have been substituted for the unavailable measured data. For sites not identified as controlled, only available measured data are reported.

The following 19 CSOs were identified as controlled through the monitoring and modeling data:

1. 30th Ave. NE Overflow
2. 53rd Avenue Southwest Pump Station Overflow (53rd Ave. SW PS Overflow)
3. 63rd Avenue Southwest Overflow (63rd Ave. SW Overflow)
4. 8th Avenue South Overflow (8th Ave. S Overflow)
5. Ballard Siphon Overflow
6. Canal Street Overflow (Canal St. Overflow)
7. Dexter Ave. RS Overflow
8. E Duwamish PS Overflow
9. East Marginal Way Pump Station Overflow (E Marginal Way PS Overflow)
10. East Pine Street Pump Station Overflow (E Pine St. PS Overflow)
11. Henderson Street Pump Station Overflow (Henderson St. PS Overflow)
12. Martin Luther King Junior Way Overflow (MLK Jr. Way Overflow)
13. Matthews Park Pump Station Overflow (Matthews Park PS Overflow)
14. Norfolk Street Overflow (Norfolk St. Overflow)
15. North Beach Inlet
16. North Beach Wet Well
17. Rainier Avenue Pump Station Overflow (Rainier Ave. PS Overflow)
18. SW Alaska St. Overflow
19. W Duwamish Overflow.

Projects previously completed at two CSO sites, Denny Way RS Overflow and Harbor Ave. RS, have not fully achieved control to the Washington state standard. Work completed or currently under way to complete control at these two locations is described in Section 3.1 of this report.

The Belvoir PS Overflow was reported as controlled in past annual reports. However, updated modeling indicates that it is uncontrolled in 2016 due to upstream changes in the SPU system, which is contributing additional flows to the regional system.

WTD developed four versions of its flow model to analyze the effects of changed flows from SPU's retrofits to WTD's system over time from pre 2003 to post 2014 conditions. The four versions of the model covered years 2002, 2007, 2013/2014 and 2015. The model results show that the construction of SPU projects in the Windermere area (CSOs 13, 14, and 15) between 2002 and 2007, increased peak and average flow to the Belvoir PS, causing Belvoir PS to move from less than one-event per year to 1.5 events per year on the 20-year moving average.

In addition, the model indicates that changes made to the SPU system between 2008 and 2013 sent higher flows to the Belvoir PS, with that station experiencing more modeled overflows. The model also indicates that the SPU project changes between 2002 and 2013 caused the one-year control volume at Belvoir PS to increase from zero to between 0.14 – 0.19 million gallons, depending on whether the long-term average or the maximum 20-year period methodology is used. Belvoir Pump Station was adjusted in 2015 to maintain compliance at the downstream 30th Ave Pump Station.

WTD and SPU have agreed to work together to resolve this compliance issue in 2017. Plans and corrective actions will be communicated to Ecology and EPA, and documented in next year's CSO and CD annual report.

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Table 6. King County Untreated CSO Events, Averages, and Baselines, 1997–2016

Overflow Name	Discharge Serial Number (DSN)	1997[a]	1998	1999	2000[b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	20-Year Average	1983 Baseline (24 hr inter-event)
11th Ave. NW[d]	004	21	10	12	14	14	8	8	6	11	22	10	7	16	19	16	20	12	25	17	22	**14.7**	16
30th Ave. NE	049	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5	0	3	1	1	2	3	1	**0.3**	1
3rd Ave. W[e]	008	9	8	4	1	11	4	6	4	5	13	6	3	9	8	7	13	5	12	7	5	**7.0**	17
53rd Ave. SW PS[f]	052	NM	NM	NM	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	**0.2**	<1
63rd Ave. SW	054	NM	NM	NM	0	0	0	2	0	1	0	0	0	0	1	1	3	2	2	4	5	**1.1**	2
8th Ave. S	040	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.1**	6
Ballard Siphon[g]	003	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*2*	0	0	**0.3**	13
Barton St. PS[f]	057	NM	NM	NM	0	0	0	3	4	5	11	3	1	2	4	1	4	5	11	5	2	**3.6**	9
Belvoir PS	012	*1*	*1*	*0*	*0*	*0*	*0*	*4*	*0*	*0*	*1*	*1*	*0*	*5*	*1*	*2*	*2*	*2*	*2*	5	2	**1.5**	1
Brandon St. RS[h]	041	40	31	32	30	30	21	28	21	27	11	NM	3	16	11	7	12	7	16	14	12	**19.4**	36
Canal St.	007	1	2	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	**0.5**	1
Chelan Ave. RS	036	8	5	5	2	7	2	3	1	2	5	2	0	0	3	4	13	4	13	13	9	**5.1**	7
Denny Way RS	027a	37	23	23	25	26	15	25	20	11	9	1	2	4	2	2	1	2	1	5	1	**11.8**	32
Dexter Ave. RS	009	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	1	0	**0.4**	15
E Duwamish PS[d]	034	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	**0.2**	1
E Marginal Way PS	043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
E Pine St.	011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
Hanford #1[d,I,j]	031a	14	17	5	0	0	3	6	8	NM	16	4	6	14	13	13	18	10	26	16	22	**11.1**	30
Hanford #2 RS	032	17	17	18	17	13	10	12	16	15	26	12	8	17	17	15	23	9	27	16	24	**16.5**	28
Harbor Ave. RS[k]	037	1	1	0	0	2	0	2	0	3	5	2	0	0	1	1	3	2	1	4	2	**1.5**	30
Henderson St. PS[l]	045	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0	0	**0.0**	12
King St. RS	028	18	11	14	10	14	12	16	15	20	27	7	3	15	18	15	13	2	23	19	14	**14.3**	16

Twenty Year Moving Average of Event Frequencies

Overflow Name	Discharge Serial Number (DSN)	1997[a]	1998	1999	2000[b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	20-Year Average	1983 Baseline (24 hr inter-event)
Kingdome RS	029	11	3	0	1	0	0	0	2	5	4	5	1	8	6	2	11	6	22	17	12	**5.8**	29
Lander St. RS	030	12	10	15	11	10	10	12	9	8	28	8	6	19	17	15	25	8	29	17	25	**14.7**	26
Matthews Park PS	018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
MLK Jr. Way[l]	013	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0	0	**0.0**	16
Montlake RS	014	2	7	0	2	0	5	11	5	6	NM	0	1	3	10	8	18	7	20	15	16	**7.2**	6
Murray St. PS[f]	056	NM	NM	NM	0	0	0	3	5	10	10	3	1	11	8	3	5	2	3	6	2	**3.6**	5
Norfolk St.[l]	044a	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	1	0	**0.1**	20
North Beach PS Inlet[d]	048b	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	**0.0**	18
North Beach PS Wet Well[m]	048a	*2*	*0*	*0*	*0*	*1*	*0*	*2*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*2*	*1*	*1*	*1*	*2*	1	**0.8**	18
Rainier Ave. PS	033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
S Magnolia[d]	006	34	19	5	0	0	5	18	17	26	30	21	26	25	38	22	36	16	38	23	15	**20.7**	25
S Michigan St. RS	042	0	0	10	8	12	8	9	6	5	13	5	3	10	12	14	16	8	26	17	16	**9.9**	5
SW Alaska St.[d]	055	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	**0.3**	1
Terminal 115[d,n]	038	NM	NM	NM	NM	NM	NM	2	0	2	7	4	0	3	3	0	1	1	0	1	1	**1.3**	4
University RS	015	9	10	4	3	5	4	4	4	3	12	5	3	9	8	6	13	4	14	11	9	**7.0**	13
W Duwamish[d]	035	NM	NM	NM	NM	NM	NM	NM	NM	1	0	1	0	0	1	0	0	1	0	0	0	**0.3**	1
W Michigan St.[o]	039	6	3	3	2	7	5	4	1	3	8	4	0	8	9	3	5	2	3	6	9	**4.6**	34

Notes: Modeled numbers are shown in *italics*.
[a] CSO "event" definition changed to be based on a 48-hour dry period.
[b] CSO "event" definition changed to be based on a 24-hour dry period.
[c] Blue 20-year averages are those that meet the no more than one event per year on a 20-year average and therefore are in control. Black 20-year averages are for uncontrolled basins.
[d] Portable monitors are used at 11th Ave. NW, 30th Ave NE, SW Alaska St., Bayview North and South, E Duwamish, W Duwamish, Hanford @ Rainier, S Magnolia, North Beach PS Inlet, and Terminal 115. The Bayview North monitor was installed in 2010; the Bayview South monitor was installed in 2011.
[e] The 3rd Ave. W monitor was down June 2006 through November 2006.
[f] Monitoring began in June 2000 at 53rd Ave. SW PS, 63rd Ave. SW, Barton St., and Murray St.
[g] Years 1997-2013 are modeled data and numbers may be updated in future reports as new information is gathered. Modeled data have been substituted to simulate how current facilities would have performed under rain patterns during that time.
[h] The monitor at Brandon St. RS was down June 2006 to March 2008. A portable monitor was installed in March 2008. Monitoring by SCADA was restored beginning with the 2009 period.
[i] Monitoring began at 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 June 2007 to December 2007. From June 2005 to May 2006 the portable meter provided questionable data.
[k] No data were recorded at Harbor Ave. in April and May 2004.
[l] Henderson, MLK Jr. Way, and Norfolk St. 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.
[m] Monitoring began in June 2005 at North Beach wet well.
[n] Monitoring began in June 2003 at Terminal 115.
[o] Monitoring began at W Duwamish in June 2005.

7 Post-Construction Monitoring

King County's Post-Construction Monitoring Plan (PCMP) was approved by Ecology on September 28, 2012. Monitoring volume and frequency of overflows at the controlled untreated discharge locations listed above is ongoing, reported monthly to Ecology, and summarized in each CSO Annual Report (Appendix A and B). Volume, frequency, and NPDES permit effluent monitoring and effluent compliance for the wet weather treatment stations are reported monthly and summarized in Appendix B.

King County's ongoing ambient monitoring program provides data for post-construction monitoring as described in the PCMP. Additional details can be found in the PCMP's 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 Quality Assurance Project Plan).

Sediment monitoring for controlled sites is being performed as described in the PCMP. Details can be found in the PCMP's Appendix C (Sampling and Analyses Plan). Sediment characterization data for 2012 was submitted to Ecology in April 2014. The Sediment Management Plan Update (SMP Update), which will contain modeling results for those CSOs not proposed to be sampled, will be available for Ecology review in 2017.

Design of a sampling plan specific to the Ballard Siphon site was completed in October 2015, in accordance with the PCMP. Data sampling collection was completed October 15, 2015. Analysis began shortly afterwards and continued in 2016. A subsequent data validation effort was performed later in 2016, the results of which are informing the SMP Update.

Appendices

Appendix A. Untreated CSO Events, January–December 2016

Appendix B. Treated CSO Events, January–December 2016

Appendix C. Alki Wet Weather Treatment Station 2016 Annual Report

Appendix D. Carkeek Wet Weather Treatment Station 2016 Annual Report

Appendix E. Elliott West Wet Weather Treatment Station 2016 Annual Report

Appendix F. Henderson/MLK Jr. Way Wet Weather Treatment Station 2016 Annual Report

Appendix A
Untreated CSO Events

January–December 2016

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	N/A	N/A	N/A	N/A	N/A	N/A	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	1/21/2016 6:39:00 AM	1/22/2016 5:42:00 AM	23.05	2,196,997	4.17	164.95	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	1/23/2016 12:07:00 PM	1/23/2016 12:40:00 PM	0.55	51,890	0.43	6.45	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	1/27/2016 8:29:00 PM	1/28/2016 6:11:00 AM	9.70	344,130	1.44	48.97	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	2/12/2016 12:45:00 AM	2/12/2016 10:55:00 AM	10.17	608,611	0.89	20.05	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	2/17/2016 8:38:00 PM	2/17/2016 9:14:00 PM	0.60	87,230	0.31	6.68	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	3/3/2016 1:00:00 PM	3/3/2016 1:10:00 PM	0.17	412	1.29	101.78	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	3/9/2016 5:24:00 PM	3/10/2016 2:21:00 AM	8.95	401,880	1.24	25.62	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	3/11/2016 11:18:00 PM	3/11/2016 11:34:00 PM	0.27	7,044	0.48	10.40	
004	11th Ave NW (AKA East Ballard)[1]	Lake Washington Ship Canal	3/13/2016 9:42:00 AM	3/13/2016 10:54:00 AM	1.20	64,943	1.59	45.93	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	6/23/2016 8:42:00 PM	6/23/2016 8:58:00 PM	0.27	22,437	0.29	20.18	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	9/2/2016 9:53:00 AM	9/2/2016 10:46:00 AM	0.88	243,847	0.43	12.28	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	9/19/2016 7:25:00 AM	9/19/2016 7:38:00 AM	0.22	20,654	0.19	1.48	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	10/13/2016 7:46:00 PM	10/14/2016 12:50:00 PM	17.07	914,147	2.47	35.40	
004	11th Ave NW (AKA East Ballard)[1]	Lake Washington Ship Canal	10/15/2016 1:24:00 PM	10/15/2016 1:40:00 PM	0.27	6,835	3.11	60.20	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	10/20/2016 3:00:00 AM	10/20/2016 10:01:00 AM	7.02	495,125	1.20	13.42	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	10/26/2016 9:26:00 AM	10/26/2016 8:46:00 PM	11.33	421,537	1.24	14.38	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	10/31/2016 9:16:00 AM	10/31/2016 9:51:00 AM	0.58	75,796	0.46	18.92	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	11/5/2016 8:42:00 AM	11/5/2016 9:10:00 AM	0.47	77,047	0.36	5.40	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	11/15/2016 2:50:00 AM	11/15/2016 6:12:00 AM	3.37	587,592	1.10	45.67	
004	11th Ave NW (AKA East Ballard)	Lake Washington Ship Canal	11/22/2016 10:20:00 PM	11/22/2016 11:37:00 PM	1.28	41,898	0.60	8.60	
004	11th Ave NW (AKA East Ballard)[1]	Lake Washington Ship Canal	11/24/2016 7:07:00 AM	11/24/2016 6:37:00 PM	11.50	119,028	1.74	51.62	
004	11th Ave NW (AKA East Ballard)[1]	Lake Washington Ship Canal	11/26/2016 7:15:00 AM	11/26/2016 8:02:00 AM	0.78	58,173	2.42	89.03	
006	Magnolia Overflow	Elliott Bay/Puget Sound	9/19/2016 7:02:00 AM	9/19/2016 7:14:00 AM	0.20	<160	*0.12*	1.2	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/13/2016 7:10:00 AM	10/14/2016 12:41:00 PM	29.52	179,913	2.71	35.35	
006	Magnolia Overflow[1]	Elliott Bay/Puget Sound	10/15/2016 1:03:00 PM	10/15/2016 1:20:00 PM	0.28	1,178	3.35	60.02	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/20/2016 2:26:00 AM	10/20/2016 9:58:00 AM	7.53	123,941	1.30	13.43	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/26/2016 8:57:00 AM	10/26/2016 10:34:00 PM	13.62	118,518	1.24	16.55	
006	Magnolia Overflow	Elliott Bay/Puget Sound	10/31/2016 8:52:00 AM	10/31/2016 9:29:00 AM	0.62	6,858	0.73	49.35	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/5/2016 8:26:00 AM	11/5/2016 9:02:00 AM	0.60	47,041	0.30	5.40	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/15/2016 2:34:00 AM	11/15/2016 8:54:00 PM	18.33	52,864	0.94	21.27	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/22/2016 10:12:00 PM	11/22/2016 11:22:00 PM	1.17	1,375	0.58	8.13	
006	Magnolia Overflow[1]	Elliott Bay/Puget Sound	11/24/2016 5:52:00 AM	11/24/2016 11:28:00 PM	17.60	7,766	2.00	56.20	
006	Magnolia Overflow	Elliott Bay/Puget Sound	11/26/2016 6:54:00 AM	11/26/2016 8:06:00 AM	1.20	9,409	0.40	10.92	
006	Magnolia Overflow[1]	Elliott Bay/Puget Sound	11/27/2016 5:40:00 PM	11/27/2016 6:44:00 PM	1.07	7,401	0.99	45.32	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/9/2016 9:08:00 PM	12/9/2016 9:14:00 PM	0.10	<80	0.47	14.78	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/19/2016 11:46:00 PM	12/19/2016 11:48:00 PM	0.03	105	0.49	20.58	
006	Magnolia Overflow	Elliott Bay/Puget Sound	12/23/2016 9:44:00 AM	12/23/2016 9:52:00 AM	0.13	<110	1.14	23.30	
007	Canal Street Overflow	Lake Washington Ship Canal	N/A	N/A	N/A	N/A	N/A	N/A	
008	3rd Ave W and Ewing St[2]	Lake Washington Ship Canal	N/A	N/A	N/A	N/A	N/A	N/A	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/13/2016 9:11:00 PM	10/14/2016 1:30:00 PM	16.32	752,349	2.48	35.96	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/20/2016 4:09:00 AM	10/20/2016 10:32:00 AM	6.38	925,487	1.21	13.76	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/26/2016 10:42:00 AM	10/26/2016 11:38:00 AM	0.93	178,133	0.60	5.43	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/15/2016 4:24:00 AM	11/15/2016 6:24:00 AM	2.00	390,984	1.10	45.67	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/22/2016 11:32:00 PM	11/23/2016 12:11:00 AM	0.65	18,795	0.61	8.90	
009	Dexter Ave Regulator	Lake Union	N/A	N/A	N/A	N/A	N/A	N/A	
011	E Pine St. Pump Station Emergency Overflow	Lake Washington	N/A	N/A	N/A	N/A	N/A	N/A	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	1/21/2016 8:41:00 AM	1/21/2016 12:50:00 PM	4.15	32,105	3.15	146.30	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	10/26/2016 10:50:00 PM	10/26/2016 11:44:00 PM	0.90	57,413	1.49	17.42	
013	MLK Trunkline Overflow via storm drain	Lake Washington	N/A	N/A	N/A	N/A	N/A	N/A	
014	Montlake Overflow	Lake Washington Ship Canal	1/21/2016 7:58:00 AM	1/21/2016 12:50:00 PM	4.87	7,732,835	3.15	146.30	
014	Montlake Overflow	Lake Washington Ship Canal	1/23/2016 12:32:00 PM	1/23/2016 1:50:00 PM	1.30	1,199,747	0.54	8.28	
014	Montlake Overflow	Lake Washington Ship Canal	1/27/2016 9:06:00 PM	1/28/2016 7:16:00 AM	10.17	2,923,060	1.44	47.70	
014	Montlake Overflow	Lake Washington Ship Canal	2/12/2016 12:57:00 AM	2/12/2016 10:53:00 AM	9.93	3,258,116	1.20	19.72	
014	Montlake Overflow	Lake Washington Ship Canal	2/17/2016 8:52:00 PM	2/17/2016 9:03:00 PM	0.18	190,865	0.31	5.98	
014	Montlake Overflow	Lake Washington Ship Canal	3/6/2016 1:10:00 PM	3/6/2016 1:33:00 PM	0.38	543,207	2.25	174.37	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
014	Montlake Overflow	Lake Washington Ship Canal	3/9/2016 5:45:00 PM	3/9/2016 8:34:00 PM	2.82	1,375,165	0.95	20.15	
014	Montlake Overflow	Lake Washington Ship Canal	4/24/2016 9:24:00 AM	4/24/2016 9:58:00 AM	0.57	893,526	0.31	22.77	
014	Montlake Overflow	Lake Washington Ship Canal	5/19/2016 8:31:00 PM	5/19/2016 8:43:00 PM	0.20	170,591	0.48	20.58	
014	Montlake Overflow	Lake Washington Ship Canal	10/9/2016 9:07:00 PM	10/9/2016 9:31:00 PM	0.40	404,123	1.10	72.58	
014	Montlake Overflow	Lake Washington Ship Canal	10/13/2016 8:56:00 PM	10/14/2016 1:08:00 PM	16.20	6,814,668	2.92	35.38	
014	Montlake Overflow	Lake Washington Ship Canal	10/20/2016 3:42:00 AM	10/20/2016 10:27:00 AM	6.75	4,474,108	1.40	13.67	
014	Montlake Overflow	Lake Washington Ship Canal	10/26/2016 9:42:00 AM	10/27/2016 12:16:00 AM	14.57	7,656,476	1.50	17.73	
014	Montlake Overflow	Lake Washington Ship Canal	10/31/2016 9:34:00 AM	10/31/2016 10:03:00 AM	0.48	519,217	0.60	20.25	
014	Montlake Overflow	Lake Washington Ship Canal	11/15/2016 3:35:00 AM	11/15/2016 6:17:00 AM	2.70	2,687,829	1.22	45.93	
014	Montlake Overflow	Lake Washington Ship Canal	11/24/2016 6:23:00 PM	11/24/2016 6:33:00 PM	0.17	139,044	1.90	51.28	
015	University Regulator	Lake Washington Ship Canal	1/21/2016 8:09:00 AM	1/21/2016 10:05:00 PM	13.93	28,199,892	3.54	156.00	
015	University Regulator	Lake Washington Ship Canal	1/27/2016 9:30:00 PM	1/27/2016 11:49:00 PM	2.32	4,841,382	0.97	40.58	
015	University Regulator	Lake Washington Ship Canal	2/12/2016 1:18:00 AM	2/12/2016 11:12:00 AM	9.90	3,568,572	1.21	20.20	
015	University Regulator	Lake Washington Ship Canal	3/9/2016 6:51:00 PM	3/9/2016 9:04:00 PM	2.22	4,103,464	0.97	20.62	
015	University Regulator	Lake Washington Ship Canal	10/13/2016 9:36:00 PM	10/14/2016 1:10:00 PM	15.57	7,818,091	2.92	35.38	
015	University Regulator	Lake Washington Ship Canal	10/20/2016 3:57:00 AM	10/20/2016 10:21:00 AM	6.40	4,346,299	1.40	13.67	
015	University Regulator	Lake Washington Ship Canal	10/26/2016 10:27:00 AM	10/26/2016 11:23:00 AM	0.93	1,130,656	0.58	4.75	
015	University Regulator	Lake Washington Ship Canal	11/15/2016 4:30:00 AM	11/15/2016 6:12:00 AM	1.70	3,502,105	1.22	45.93	
015	University Regulator	Lake Washington Ship Canal	11/22/2016 11:59:00 PM	11/23/2016 12:14:00 AM	0.25	317,810	0.71	8.92	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
018	Matthews Park Pump Station Emergency Overflows	Lake Washington	N/A	N/A	N/A	N/A	N/A	N/A	
027a	Denny Way Regulator	Elliott Bay	10/26/2016 10:36:30 PM	10/26/2016 11:09:00 PM	0.54	1,683,421	1.29	17.07	
028	King Street Regulator	Elliott Bay	1/21/2016 7:25:00 AM	1/21/2016 2:19:00 PM	6.90	2,723,693	1.32	17.32	
028	King Street Regulator	Elliott Bay	1/23/2016 12:22:00 PM	1/23/2016 1:17:00 PM	0.92	25,281	0.49	7.67	
028	King Street Regulator	Elliott Bay	1/27/2016 9:17:00 PM	1/28/2016 8:52:00 AM	11.58	6,204,903	1.29	49.43	
028	King Street Regulator	Elliott Bay	2/3/2016 7:38:00 PM	2/3/2016 8:13:00 PM	0.58	28,755	0.30	13.45	
028	King Street Regulator	Elliott Bay	2/12/2016 12:46:00 AM	2/12/2016 10:46:00 AM	10.00	957,029	1.04	19.63	
028	King Street Regulator	Elliott Bay	3/9/2016 5:33:00 PM	3/9/2016 10:01:00 PM	4.47	753,313	0.78	22.07	
028	King Street Regulator	Elliott Bay	3/13/2016 11:28:00 AM	3/13/2016 12:35:00 PM	1.12	137,106	0.84	46.37	
028	King Street Regulator	Elliott Bay	4/24/2016 9:07:00 AM	4/24/2016 9:20:00 AM	0.22	146,381	0.33	0.40	
028	King Street Regulator	Elliott Bay	5/19/2016 8:19:00 PM	5/19/2016 8:27:00 PM	0.13	21,098	0.42	19.78	
028	King Street Regulator	Elliott Bay	10/13/2016 9:56:00 PM	10/14/2016 11:48:00 AM	13.87	47,006	2.10	34.27	
028	King Street Regulator[1]	Elliott Bay	10/15/2016 6:51:00 PM	10/15/2016 6:57:00 PM	0.10	17,640	2.90	65.38	
028	King Street Regulator	Elliott Bay	10/20/2016 9:05:00 AM	10/20/2016 9:19:00 AM	0.23	16,797	0.99	12.50	
028	King Street Regulator	Elliott Bay	10/26/2016 10:22:00 PM	10/26/2016 11:05:00 PM	0.72	517,927	1.43	16.97	
028	King Street Regulator	Elliott Bay	11/15/2016 4:18:00 AM	11/15/2016 4:27:00 AM	0.15	27,440	0.83	44.25	
029	Kingdome[3]	Elliott Bay	1/13/2016 9:51:00 AM	1/13/2016 12:26:00 PM	2.58	812,812	1.07	48.75	
029	Kingdome	Elliott Bay	1/21/2016 8:10:00 AM	1/22/2016 7:36:00 AM	23.43	4,255,669	1.85	34.37	
029	Kingdome	Elliott Bay	1/23/2016 11:22:00 AM	1/23/2016 2:47:00 PM	3.42	1,021,028	0.55	8.98	
029	Kingdome	Elliott Bay	1/27/2016 9:11:00 PM	1/28/2016 10:06:00 AM	12.92	3,176,003	1.31	50.33	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
029	Kingdome	Elliott Bay	2/12/2016 12:54:00 AM	2/12/2016 11:37:00 AM	10.72	2,494,043	1.04	19.63	
029	Kingdome	Elliott Bay	2/17/2016 9:43:00 PM	2/17/2016 10:39:00 PM	0.93	130,101	0.38	7.33	
029	Kingdome	Elliott Bay	3/9/2016 4:47:00 PM	3/9/2016 9:32:00 PM	4.75	1,519,951	0.77	20.88	
029	Kingdome	Elliott Bay	6/21/2016 1:55:00 AM	6/21/2016 2:10:00 AM	0.25	13,177	0.42	2.53	
029	Kingdome	Elliott Bay	10/13/2016 9:55:00 PM	10/14/2016 12:48:00 PM	14.88	846,412	2.22	35.12	
029	Kingdome	Elliott Bay	10/20/2016 6:18:00 AM	10/20/2016 9:26:00 AM	3.13	114,675	1.00	12.67	
029	Kingdome	Elliott Bay	10/26/2016 10:33:00 PM	10/26/2016 11:27:00 PM	0.90	2,574,968	1.45	17.25	
029	Kingdome	Elliott Bay	11/15/2016 4:23:00 AM	11/15/2016 5:13:00 AM	0.83	24,877	0.93	45.07	
030	Lander St Regulator[3]	Elliott Bay	1/12/2016 7:18:00 PM	1/13/2016 2:33:00 PM	19.25	7,398,515	1.26	49.00	
030	Lander St Regulator	Elliott Bay	1/16/2016 10:00:00 AM	1/16/2016 11:19:00 AM	1.32	4,858,994	0.38	21.85	
030	Lander St Regulator[1]	Elliott Bay	1/17/2016 11:26:00 AM	1/17/2016 12:43:00 PM	1.28	3,223,247	0.79	47.20	
030	Lander St Regulator[1]	Elliott Bay	1/19/2016 6:39:00 PM	1/19/2016 9:53:00 PM	3.23	2,913,960	1.44	106.13	
030	Lander St Regulator[1]	Elliott Bay	1/21/2016 2:52:00 AM	1/22/2016 8:37:00 AM	29.75	57,539,128	3.42	163.53	
030	Lander St Regulator	Elliott Bay	1/23/2016 10:03:00 AM	1/23/2016 5:21:00 PM	7.30	14,321,039	0.51	10.50	
030	Lander St Regulator[4]	Elliott Bay	1/27/2016 9:01:00 PM	1/29/2016 11:22:00 AM	38.35	49,887,764	1.51	51.18	
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030	Lander St Regulator	Elliott Bay	2/12/2016 12:51:00 AM	2/12/2016 1:39:00 PM	12.80	19,086,299	1.08	22.27	
030	Lander St Regulator	Elliott Bay	2/17/2016 9:42:00 PM	2/18/2016 1:03:00 AM	3.35	3,125,593	0.37	9.60	
030	Lander St Regulator	Elliott Bay	3/2/2016 12:47:00 AM	3/2/2016 12:52:00 AM	0.08	445	1.19	67.10	
030	Lander St Regulator[1]	Elliott Bay	3/6/2016 1:51:00 PM	3/6/2016 3:04:00 PM	1.22	1,334,780	2.33	175.57	
030	Lander St Regulator	Elliott Bay	3/9/2016 4:12:00 PM	3/10/2016 8:04:00 AM	15.87	43,775,432	1.12	25.85	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
030	Lander St Regulator	Elliott Bay	3/13/2016 11:25:00 AM	3/13/2016 1:16:00 PM	1.85	1,418,958	0.98	46.05	
030	Lander St Regulator	Elliott Bay	6/21/2016 1:36:00 AM	6/21/2016 2:34:00 AM	0.97	689,522	0.43	2.50	
030	Lander St Regulator	Elliott Bay	10/13/2016 9:28:00 AM	10/15/2016 8:06:00 PM	58.63	41,338,754	3.82	65.73	
030	Lander St Regulator	Elliott Bay	10/20/2016 4:06:00 AM	10/20/2016 12:09:00 PM	8.05	20,441,627	1.33	30.82	
030	Lander St Regulator	Elliott Bay	10/26/2016 10:14:00 AM	10/27/2016 1:11:00 AM	14.95	19,835,407	1.74	17.78	
030	Lander St Regulator	Elliott Bay	10/31/2016 10:33:00 AM	11/1/2016 9:01:00 AM	22.47	4,649,166	1.18	42.12	
030	Lander St Regulator	Elliott Bay	11/5/2016 10:57:00 AM	11/5/2016 10:19:00 PM	11.37	7,015,531	0.87	16.60	
030	Lander St Regulator	Elliott Bay	11/15/2016 3:41:00 AM	11/15/2016 8:19:00 AM	4.63	25,194,958	1.23	45.98	
030	Lander St Regulator	Elliott Bay	11/22/2016 10:43:00 PM	11/23/2016 12:35:00 AM	1.87	1,754,742	0.60	9.32	
030	Lander St Regulator[1]	Elliott Bay	11/24/2016 8:37:00 AM	11/25/2016 12:42:00 AM	16.08	31,145,477	2.11	56.27	
030	Lander St Regulator	Elliott Bay	11/26/2016 10:08:00 AM	11/26/2016 10:22:00 AM	0.23	11,791	0.44	12.90	
030	Lander St Regulator[1]	Elliott Bay	11/27/2016 6:25:00 PM	11/27/2016 8:41:00 PM	2.27	1,748,846	1.04	45.18	
030	Lander St Regulator	Elliott Bay	12/23/2016 10:31:00 AM	12/23/2016 2:00:00 PM	3.48	5,825,997	0.93	26.40	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/13/2016 8:13:00 AM	1/13/2016 11:35:00 AM	3.37	480,037	1.24	48.00	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/21/2016 7:52:00 AM	1/22/2016 6:53:00 AM	23.02	5,068,755	3.40	162.55	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/23/2016 10:55:00 AM	1/23/2016 1:52:00 PM	2.95	517,058	0.45	8.15	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/27/2016 8:47:00 PM	1/28/2016 10:23:00 AM	13.60	4,038,985	1.51	51.18	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	2/1/2016 4:00:00 AM	2/1/2016 4:28:00 AM	0.47	52,911	0.05	1.00	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	2/12/2016 12:50:00 AM	2/12/2016 11:09:00 AM	10.32	3,459,714	1.08	22.27	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
031	Hanford #1	Duwamish River via Diagonal Storm Drain	2/17/2016 8:34:00 PM	2/17/2016 9:26:00 PM	0.87	375,510	0.30	6.80	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	3/6/2016 1:00:00 PM	3/6/2016 1:32:00 PM	0.53	261,858	2.33	175.57	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	3/9/2016 5:16:00 PM	3/9/2016 8:58:00 PM	3.70	1,685,590	0.95	20.92	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	3/27/2016 5:25:00 PM	3/27/2016 5:41:00 PM	0.27	5,872	0.30	18.38	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	4/24/2016 9:15:00 AM	4/24/2016 9:45:00 AM	0.50	251,138	0.17	0.72	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	5/19/2016 8:10:00 PM	5/19/2016 9:07:00 PM	0.95	791,965	0.28	20.63	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	6/21/2016 12:09:00 AM	6/21/2016 12:43:00 AM	0.57	220,268	0.37	1.65	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/13/2016 8:34:00 PM	10/14/2016 1:22:00 PM	16.80	7,894,103	2.96	35.78	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/15/2016 7:09:00 PM	10/15/2016 7:21:00 PM	0.20	36,935	3.82	65.73	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/20/2016 3:37:00 AM	10/20/2016 10:50:00 AM	7.22	4,136,699	1.32	30.32	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/26/2016 9:23:00 AM	10/27/2016 12:12:00 AM	14.82	6,536,929	1.74	17.78	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/31/2016 9:13:00 AM	11/1/2016 12:41:00 AM	15.47	511,735	0.92	34.32	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	11/5/2016 9:00:00 AM	11/5/2016 11:20:00 AM	2.33	39,962	0.43	6.13	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	11/15/2016 3:29:00 AM	11/15/2016 6:40:00 AM	3.18	2,323,437	1.23	45.98	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	11/24/2016 11:32:00 AM	11/25/2016 12:08:00 AM	12.60	841,341	2.11	56.27	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	11/27/2016 6:07:00 PM	11/27/2016 7:13:00 PM	1.10	334,251	1.04	45.18	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
032	Hanford #2 Regulator[3]	Duwamish River - East Waterway	1/12/2016 7:18:00 PM	1/13/2016 3:23:00 PM	20.08	9,092,743	1.26	49.00	
032	Hanford #2 Regulator[5]	Duwamish River - East Waterway	1/17/2016 12:23:00 PM	1/17/2016 6:46:00 PM	6.38	3,118,000	0.94	54.78	
032	Hanford #2 Regulator[1]	Duwamish River - East Waterway	1/19/2016 6:38:00 PM	1/20/2016 1:47:00 AM	7.15	6,296,549	1.44	106.13	
032	Hanford #2 Regulator[1, 4]	Duwamish River - East Waterway	1/21/2016 3:15:00 AM	1/23/2016 7:01:00 PM	63.77	62,085,671	3.42	163.53	
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032	Hanford #2 Regulator[4]	Duwamish River - East Waterway	1/27/2016 9:02:00 PM	1/29/2016 1:08:00 PM	40.10	26,780,617	1.51	51.18	
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032	Hanford #2 Regulator	Duwamish River - East Waterway	2/11/2016 6:24:00 PM	2/12/2016 3:39:00 PM	21.25	23,668,526	1.08	22.27	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/17/2016 9:41:00 PM	2/18/2016 12:54:00 AM	3.22	3,104,976	0.37	9.60	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/2/2016 12:39:00 AM	3/2/2016 3:43:00 AM	3.07	2,186,187	1.22	70.02	
032	Hanford #2 Regulator[1]	Duwamish River - East Waterway	3/6/2016 1:52:00 PM	3/7/2016 11:17:00 AM	21.42	1,725,312	2.60	195.80	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/9/2016 4:31:00 PM	3/10/2016 8:40:00 AM	16.15	39,436,760	1.12	25.85	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/12/2016 9:03:00 AM	3/12/2016 9:39:00 AM	0.60	226,548	0.53	19.93	
032	Hanford #2 Regulator[1]	Duwamish River - East Waterway	3/13/2016 11:27:00 AM	3/13/2016 2:05:00 PM	2.63	4,429,720	0.99	48.10	
032	Hanford #2 Regulator	Duwamish River - East Waterway	6/21/2016 1:31:00 AM	6/21/2016 3:26:00 AM	1.92	4,567,807	0.43	2.50	
032	Hanford #2 Regulator[9]	Duwamish River - East Waterway	7/12/16	7/12/16	0.06	88,900	0	0	DWO
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/13/2016 9:29:00 AM	10/15/2016 8:43:00 PM	59.23	63,450,560	3.82	65.73	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/20/2016 4:06:00 AM	10/20/2016 1:46:00 PM	9.67	22,334,397	1.33	30.82	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/26/2016 10:13:00 AM	10/27/2016 2:56:00 AM	16.72	39,210,131	1.74	17.78	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/31/2016 10:31:00 AM	11/1/2016 9:27:00 AM	22.93	9,667,860	1.18	42.12	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/5/2016 11:13:00 AM	11/6/2016 5:54:00 AM	18.68	19,064,358	1.01	24.38	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/15/2016 3:42:00 AM	11/15/2016 10:03:00 AM	6.35	6,828,873	1.23	45.98	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/22/2016 10:46:00 PM	11/23/2016 2:44:00 AM	3.97	7,520,380	0.67	10.60	
032	Hanford #2 Regulator[1]	Duwamish River - East Waterway	11/24/2016 8:37:00 AM	11/25/2016 2:59:00 AM	18.37	18,540,600	2.11	56.27	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/26/2016 10:06:00 AM	11/26/2016 12:13:00 PM	2.12	3,103,339	0.46	13.42	
032	Hanford #2 Regulator[1]	Duwamish River - East Waterway	11/27/2016 6:28:00 PM	11/27/2016 9:33:00 PM	3.08	5,493,447	1.04	45.18	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/23/2016 3:32:00 AM	12/23/2016 4:02:00 PM	12.50	5,869,695	1.00	28.52	
033	Rainier Ave. Pump Station	Lake Washington	N/A	N/A	N/A	N/A	N/A	N/A	
034	East Duwamish Pump Station	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	
035	West Duwamish Pump Station	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	
036	Chelan Ave. Regulator[3]	Duwamish River - West Waterway	1/13/2016 10:27:00 AM	1/13/2016 1:23:00 PM	2.93	240,441	1.26	49.00	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	1/21/2016 7:10:00 AM	1/21/2016 3:14:00 PM	8.07	1,258,382	2.87	147.42	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	1/28/2016 12:01:00 AM	1/28/2016 8:50:00 AM	8.82	1,259,447	1.50	50.90	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	10/13/2016 9:02:00 PM	10/14/2016 3:22:00 PM	18.33	3,503,359	2.97	37.10	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	10/20/2016 4:30:00 AM	10/20/2016 12:00:00 PM	7.50	3,095,110	1.33	30.82	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	10/26/2016 10:14:00 AM	10/27/2016 1:00:00 AM	14.77	1,056,237	1.74	17.78	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	11/15/2016 4:36:00 AM	11/15/2016 8:27:00 AM	3.85	5,293,990	1.23	45.98	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	11/24/2016 10:50:00 PM	11/24/2016 11:13:00 PM	0.38	14,725	2.10	56.07	
036	Chelan Ave. Regulator	Duwamish River - West Waterway	11/27/2016 7:09:00 PM	11/27/2016 7:35:00 PM	0.43	27,421	1.04	45.18	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	6/18/2016 3:46:00 PM	6/18/2016 3:47:00 PM	0.02	3,555	0.27	22.9	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	10/15/2016 6:40:00 PM	10/15/2016 6:41:00 PM	0.02	10,605	3.80	65.37	
038	Terminal 115 Overflow	Duwamish River	1/21/2016 10:30:00 AM	1/21/2016 1:40:00 PM	3.17	257,576	1.63	66.03	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
039	Michigan S. Regulator[3]	Duwamish River	1/13/2016 10:45:00 AM	1/13/2016 11:54:00 AM	1.15	670,210	1.26	48.72	
039	Michigan S. Regulator	Duwamish River	1/21/2016 8:22:00 AM	1/21/2016 1:03:00 PM	4.68	2,018,222	1.62	64.52	
039	Michigan S. Regulator	Duwamish River	1/27/2016 8:51:00 PM	1/28/2016 6:17:00 AM	9.43	2,556,876	1.62	49.27	
039	Michigan S. Regulator	Duwamish River	2/12/2016 12:39:00 AM	2/12/2016 11:08:00 AM	10.48	4,092,917	1.23	19.75	
039	Michigan S. Regulator	Duwamish River	2/17/2016 8:32:00 PM	2/17/2016 10:14:00 PM	1.70	472,863	0.43	7.65	
039	Michigan S. Regulator	Duwamish River	3/6/2016 1:05:00 PM	3/6/2016 1:37:00 PM	0.53	65,337	0.74	46.75	
039	Michigan S. Regulator	Duwamish River	3/9/2016 5:36:00 PM	3/9/2016 9:38:00 PM	4.03	1,146,975	0.92	21.28	
039	Michigan S. Regulator	Duwamish River	3/13/2016 11:29:00 AM	3/13/2016 11:48:00 AM	0.32	3,898	0.96	46.22	
039	Michigan S. Regulator	Duwamish River	6/21/2016 12:08:00 AM	6/21/2016 1:40:00 AM	1.53	833,233	0.57	2.78	
039	Michigan S. Regulator[6]	Duwamish River	10/13/2016 8:29:00 PM	10/15/2016 1:36:00 AM	29.12	6,504,633	3.18	47.82	
039	Michigan S. Regulator[6]	Duwamish River	10/20/2016 3:31:00 AM	10/20/2016 10:52:00 AM	7.35	4,891,905	1.32	30.32	
039	Michigan S. Regulator	Duwamish River	10/26/2016 9:12:00 AM	10/27/2016 12:01:00 AM	14.82	2,149,870	1.52	17.98	
039	Michigan S. Regulator	Duwamish River	10/31/2016 9:06:00 AM	11/1/2016 12:45:00 AM	15.65	1,231,033	1.00	40.78	
039	Michigan S. Regulator	Duwamish River	11/15/2016 4:27:00 AM	11/15/2016 7:12:00 AM	2.75	4,301,396	1.32	45.68	
039	Michigan S. Regulator	Duwamish River	11/24/2016 9:42:00 PM	11/24/2016 9:53:00 PM	0.18	556	1.85	54.57	
039	Michigan S. Regulator	Duwamish River	11/27/2016 6:19:00 PM	11/27/2016 7:12:00 PM	0.88	15,235	0.94	45.78	
040	8th Ave South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	
041	Brandon Street Regulator[3]	Duwamish River	1/13/2016 10:51:00 AM	1/13/2016 11:39:00 AM	0.80	593,227	1.24	48.00	
041	Brandon Street Regulator	Duwamish River	1/21/2016 8:13:00 AM	1/21/2016 2:25:00 PM	6.20	3,962,505	2.84	146.20	
041	Brandon Street Regulator	Duwamish River	1/27/2016 9:26:00 PM	1/28/2016 9:53:00 AM	12.45	11,658,745	1.51	51.18	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
041	Brandon Street Regulator	Duwamish River	2/12/2016 12:51:00 AM	2/12/2016 10:37:00 AM	9.77	3,758,926	1.08	22.27	
041	Brandon Street Regulator	Duwamish River	2/17/2016 9:41:00 PM	2/18/2016 12:02:00 AM	2.35	251,976	0.36	8.97	
041	Brandon Street Regulator	Duwamish River	3/6/2016 12:57:00 PM	3/6/2016 1:03:00 PM	0.10	60	2.32	175.38	
041	Brandon Street Regulator	Duwamish River	3/9/2016 6:14:00 PM	3/9/2016 10:27:00 PM	4.22	1,727,154	0.99	22.47	
041	Brandon Street Regulator	Duwamish River	6/21/2016 12:16:00 AM	6/21/2016 1:22:00 AM	1.10	252,211	0.41	2.20	
041	Brandon Street Regulator	Duwamish River	10/13/2016 9:26:00 PM	10/14/2016 2:49:00 PM	17.38	4,081,289	2.97	37.10	
041	Brandon Street Regulator	Duwamish River	10/20/2016 3:34:00 AM	10/20/2016 11:45:00 AM	8.18	6,749,079	1.33	30.82	
041	Brandon Street Regulator	Duwamish River	10/26/2016 9:54:00 AM	10/26/2016 11:28:00 PM	13.57	575,023	1.73	17.32	
041	Brandon Street Regulator	Duwamish River	11/15/2016 4:28:00 AM	11/15/2016 7:59:00 AM	3.52	4,962,729	1.23	45.98	
042	Michigan W Regulator	Duwamish River	1/21/2016 10:27:00 AM	1/21/2016 1:29:00 PM	3.03	342,685	1.62	64.52	
042	Michigan W Regulator	Duwamish River	1/27/2016 10:32:00 PM	1/28/2016 7:38:00 AM	9.10	418,976	1.64	49.72	
042	Michigan W Regulator	Duwamish River	2/12/2016 1:32:00 AM	2/12/2016 2:27:00 AM	0.92	65,061	0.82	11.35	
042	Michigan W Regulator[6]	Duwamish River	10/14/2016 8:17:00 AM	10/14/2016 2:09:00 PM	5.87	217,254	2.96	35.78	
042	Michigan W Regulator[6]	Duwamish River	10/20/2016 9:49:00 AM	10/20/2016 10:26:00 AM	0.62	53,107	1.32	30.32	
042	Michigan W Regulator	Duwamish River	11/9/2016 10:04:00 AM	11/9/2016 10:11:00 AM	0.12	446	0.20	4.32	
042	Michigan W Regulator	Duwamish River	11/15/2016 12:20:00 AM	11/15/2016 12:41:00 PM	12.35	241,175	1.34	49.47	
042	Michigan W Regulator	Duwamish River	11/22/2016 9:07:00 PM	11/23/2016 12:05:00 AM	2.97	35,790	0.55	8.95	
042	Michigan W Regulator[1, 4]	Duwamish River	11/24/2016 6:02:00 AM	11/28/2016 12:35:00 AM	90.55	997,324	1.96	56.38	
--	--	--	--	--	--	--	0.95	49.60	
043	East Marginal Pump Station	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	
044a	Norfolk Outfall	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	

Appendix A Untreated CSO Events

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
045	Henderson Pump Station	Lake Washington	1/30/2016 8:50:00 PM	1/30/2016 9:02:00 PM	0.20	18,000	N/A	N/A	DWO
048a	North Beach Pump Station (wet well)[7]	Puget Sound	1/21/2016 8:53:34 AM	1/22/2016 6:30:26 AM	21.61	2,222,495	4.21	165.51	
048b	North Beach Pump Station (inlet structure)	Puget Sound	N/A	N/A	N/A	N/A	N/A	N/A	
049	30th Avenue NE Pump Station	Lake Washington	2/12/2016 1:28:52 AM	2/12/2016 1:33:52 AM	0.08	326	0.70	10.45	
052	53rd Avenue SW Pump Station	Puget Sound	N/A	N/A	N/A	N/A	N/A	N/A	
054	63rd Avenue SW Pump Station	Puget Sound	1/21/2016	1/21/2016	11.6	14,000	N/A	N/A	SSO
054	63rd Avenue SW Pump Station	Puget Sound	1/21/2016 10:14:00 AM	1/21/2016 3:58:00 PM	5.73	16,752,831	2.89	147.80	
054	63rd Avenue SW Pump Station	Puget Sound	1/23/2016 2:05:00 PM	1/23/2016 4:11:00 PM	2.10	1,730,168	0.51	10.50	
054	63rd Avenue SW Pump Station	Puget Sound	1/28/2016 6:05:00 AM	1/28/2016 7:36:00 AM	1.52	745,449	1.48	48.72	
054	63rd Avenue SW Pump Station	Puget Sound	10/14/2016 7:33:00 AM	10/14/2016 1:26:00 PM	5.88	12,521,126	2.96	35.78	
054	63rd Avenue SW Pump Station	Puget Sound	10/26/2016 10:42:00 PM	10/26/2016 11:59:00 PM	1.28	7,184,181	1.74	17.78	
055	SW Alaska Street Overflow[8]	Puget Sound	N/A	N/A	N/A	N/A	N/A	N/A	
056	Murray Street Pump Station	Puget Sound	1/21/2016 8:11:00 AM	1/21/2016 11:18:00 AM	3.12	89,866	2.70	143.45	
056	Murray Street Pump Station	Puget Sound	2/12/2016 12:51:00 AM	2/12/2016 1:19:00 AM	0.47	222,157	0.66	13.25	
057	Barton Street Pump Station	Puget Sound	10/14/2016 11:55:00 AM	10/14/2016 12:03:00 PM	0.13	16,904	3.06	35.22	
057	Barton Street Pump Station	Puget Sound	10/26/2016 10:44:00 PM	10/26/2016 10:49:00 PM	0.08	5,224	1.62	16.98	
Total Volume (does not include any DWO or SSO volumes)						**1,064,477,149**			

Notes:

(1) This storm event includes the previous storm event.

(2) The sensors at 3rd Ave. West were not reading properly due to failing conduit and struts from 1/1/16 to 3/30/16. A Hach flow meter was installed at the site on 3/31/16.

(3) This storm may have been slightly longer, but the PI server was not recording from 1/10/16 3:10 to 1/11/16 11:07.

(4) This CSO event was caused by two distinct rainfall events.

(5) The trunk level pegged at the top of span.

(6) Based on Chelan rain gauge since E. Marg. Rain gauge was not working properly.

(7) This volume has been adjusted to account for the overflow being limited by outfall capacity and tide.

(8) The portable flow meter at SW Alaska Street Overflow was not working properly from 1/1/16 to 1/4/16.

(9) See letter for ERTS 666252 for event details.

Appendix B
Treated CSO Events

January–December 2016

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
051b	Alki WWTS[1]	Puget Sound	1/22/16 9:47 AM	1/21/2016 9:51:00 AM	20.40	30,510,000	3.49	163.54	
051b	Alki WWTS	Puget Sound	1/28/2016 1:05:00 PM	1/28/16 02:44AM	10.34	15,570,000	1.52	51.18	
051b	Alki WWTS	Puget Sound	3/10/2016 8:02:00 AM	3/9/2016 9:09:00 PM	9.20	8,810,000	1.11	26.57	
051b	Alki WWTS	Puget Sound	10/14/2016 3:19:00 PM	10/14/2016 1:42:00 AM	6.72	9,350,000	3.22	37.1	
051b	Alki WWTS	Puget Sound	10/20/2016 12:35:00 PM	10/20/2016 9:23:00 AM	2.72	3,020,000	1.35	30.82	
051b	Alki WWTS	Puget Sound	10/27/2016 2:08:00 AM	10/26/2016 11:10:00 PM	2.27	2,750,000	1.74	17.78	
046b	Carkeek WWTS[1]	Puget Sound	1/23/2016 3:36:00 PM	1/21/2016 7:42:00 AM	40.72	11,890,000	4.79	178.45	
046b	Carkeek WWTS	Puget Sound	1/28/2016 6:09:00 PM	1/27/2016 11:54:00 PM	18.55	2,000,000	1.55	56.98	
046b	Carkeek WWTS	Puget Sound	3/10/2016 3:47:00 AM	3/9/2016 8:31:00 PM	2.9	130,000	1.26	25.62	
046b	Carkeek WWTS	Puget Sound	10/14/16 2:43 PM	10/14/2016 7:50:00 AM	4.32	340,000	2.68	36.21	
046b	Carkeek WWTS	Puget Sound	10/21/2016 2:16:00 PM	10/20/2016 6:18:00 AM	7.8	1,020,000	1.23	14.52	
046b	Carkeek WWTS	Puget Sound	10/27/2016 2:47:00 AM	10/26/2016 11:06:00 AM	9.58	950,000	1.42	20.12	
046b	Carkeek WWTS[2]	Puget Sound	11/25/2016 2:51:00 AM	11/24/2016 6:16:00 PM	8.42	1,040,000	2.00	64	
046b	Carkeek WWTS[3]	Puget Sound	11/27/2016 11:20:00 PM	11/27/2016 7:00:00 PM	4.33	310,000	1.02	63.35	
027b	Elliott West WWTS[4]	Puget Sound	1/22/16 8:15 AM	1/21/2016 8:12:00 AM	18.70	29,180,000	3.47	167	

Appendix B Treated CSO Events

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
027b	Elliott West WWTS[5]	Puget Sound	1/28/2016 8:41:00 AM	1/27/2016 11:21:00 PM	9.40	9,880,000	1.29	49.1	
027b	Elliott West WWTS	Puget Sound	2/12/16 12:42 PM	2/11/2016 3:12:00 AM	5.20	7,140,000	1.14	19.8	
027b	Elliott West WWTS	Puget Sound	3/9/2016 11:03:00 PM	3/9/2016 6:56:00 PM	4.10	6,250,000	0.92	22.76	
027b	Elliott West WWTS	Puget Sound	10/14/2016 4:53:00 PM	10/13/2016 5:56:00 PM	20.40	58,150,000	2.90	37.25	
027b	Elliott West WWTS	Puget Sound	10/20/2017 12:29:00 PM	10/20/2016 5:07:00 AM	7.40	22,800,000	1.34	14.42	
027b	Elliott West WWTS	Puget Sound	10/27/2016 1:49:00 AM	10/26/16 11:11AM	8.70	23,000,000	1.31	17.62	
027b	Elliott West WWTS[6]	Puget Sound	11/15/2016 7:56:00 AM	11/15/2016 4:51:00 AM	3.10	8,090,000	0.97	6.42	
027b	Elliott West WWTS	Puget Sound	11/25/2016 12:47:00 AM	11/24/2016 6:39:00 PM	3.30	7,990,000	2.00	56.2	
044b	Henderson/MLK Jr. Way WWTS	Duwamish River	N/A	N/A	N/A	N/A	N/A	N/A	
1	West Point TP[8,9]	Puget Sound	1/12/2016 6:42:00 PM	1/13/2016 11:07:00 AM	4.69	6,470,000	1.28	47.41	
1	West Point TP[8]	Puget Sound	1/16/2016 4:39:00 PM	1/16/2016 5:25:00 PM	0.77	100,000	0.61	31.92	
1	West Point TP[8,10]	Puget Sound	1/19/2016 6:25:00 PM	1/19/2016 9:39:00 PM	4.01	2,500,000	1.55	105.72	
1	West Point TP[8,1]	Puget Sound	1/21/2016 1:54:00 AM	1/23/2016 5:01:00 PM	18.60	58,220,000	4.73	179.12	
1	West Point TP[8]	Puget Sound	1/27/2016 8:54:00 PM	1/29/2016 12:39:00 PM	21.50	45,150,000	1.70	77.27	
1	West Point TP[8]	Puget Sound	2/4/2016 1:41:00 AM	2/4/2016 2:47:00 AM	1.10	300,000	0.66	27.23	
1	West Point TP[8]	Puget Sound	2/12/2016 1:15:00 AM	2/12/2016 2:12:00 PM	7.51	18,440,000	0.89	20.05	
1	West Point TP[8]	Puget Sound	2/17/2016 10:33:00 PM	2/18/2016 12:52:00 AM	2.31	4,600,000	0.37	8.95	
1	West Point TP[8]	Puget Sound	3/7/2016 11:17:00 AM	3/7/2016 12:37:00 PM	1.33	2,060,000	2.33	195.25	
1	West Point TP[8]	Puget Sound	3/9/2016 4:21:00 PM	3/10/2016 12:39:00 AM	6.80	29,940,000	1.10	23.80	

Appendix B Treated CSO Events

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
1	West Point TP[8]	Puget Sound	3/13/2016 11:55:00 AM	3/13/2016 2:22:00 PM	2.45	4,720,000	1.69	46.75	
1	West Point TP[8]	Puget Sound	10/13/2016 9:23:00 AM	10/15/2016 3:46:00 PM	21.10	54,180,000	3.13	61.33	
1	West Point TP[8]	Puget Sound	10/20/2016 3:54:00 AM	10/20/2016 1:39:00 PM	9.45	39,230,000	1.23	14.52	
1	West Point TP[8]	Puget Sound	10/26/2016 10:19:00 AM	10/27/2016 12:58:00 AM	11.80	27,730,000	1.41	17.25	
1	West Point TP[8]	Puget Sound	10/31/2016 10:28:00 AM	11/1/2016 2:48:00 AM	3.50	7,840,000	0.85	35.92	
1	West Point TP[8]	Puget Sound	11/5/2016 10:48:00 AM	11/5/2016 1:41:00 PM	2.88	4,500,000	0.52	9.82	
1	West Point TP[8]	Puget Sound	11/15/2016 3:19:00 AM	11/15/2016 11:57:00 PM	5.40	22,500,000	1.38	61.30	
1	West Point TP[8]	Puget Sound	11/22/2016 10:31:00 PM	11/27/2016 9:34:00 PM	34.20	75,380,000	3.00	123.83	
1	West Point TP[8]	Puget Sound	12/23/2016 11:25:00 AM	12/23/2016 1:13:00 PM	1.80	2,410,000	0.84	26.38	
Total Volume						**666,440,000**			

Notes:
[1]This discharge event was result of two back-to-back storms with an 18 hour break in between.
[2] Storm duration & rainfall 11/22 -11/24. Back to back storm with 11/27 event.
[3] Storm duration & rainfall 11/25 -11/27. Back to back storm with 11/24 event.
[4] Storm started on 1/15/16.
[5] Storm started on 1/26/16.
[6] Rainfall data includes 11/14 - 11/15.
[7] Due to plant power failure.
[8] CSO - Flow exceeded 300 MGD.
[9] This storm may have been longer, but the historian was not recording from 1/10/16 3:10 to 1/11/16 11:07.
[10] This storm includes the previous storm event.

Appendix C
Alki Wet Weather Treatment Station
Annual Report

January–December 2016

Executive Summary

This 2016 annual report summarizes performance of King County's Alki Wet Weather Treatment Station (Alki WWTS). The Alki WWTS came online for CSO treatment in 1998; it operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

A total of 44.70 inches of rain fell in calendar year 2016, as measured at the rain gauge located at the Chelan Avenue Pump Station, the nearest gauge to the Alki WWTS. The annual rainfall recorded at Sea-Tac was 45.18 inches for 2016 compared to the historical annual average measured at Sea-Tac of 39.13 inches.

There were ten filling events and six discharge events during 2016. The Alki WWTS received 91.3 million gallons (MG) and discharged 70.0 MG. The annual average total suspended solids (TSS) removal was 42.8 percent for the year thereby not meeting the NPDES permit limit of 50 percent for annual removal. Alki WWTS met its annual average settleable solids (SS) limit with the average measured as 0.09 milliliters/liter/hour (ml/L/hr) with the NPDES permit limit being 0.3 ml/L/hr. The Alki WWTS met all remaining NPDES permit limits with exception of the one daily total residual chlorine limit and one monthly fecal coliform geomean.

Performance in 2016

Table C-1 summarizes NPDES permit performance in 2016.

Table C-1. Alki WWTS Permit Performance in 2016

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**6**	**29**
Discharge volume million gallons (MG)[a]	**70.0**	**108**
Annual average SS (ml/L/hr)	**0.09**	**0.3**
Annual average TSS removal- including all discharge events (%)	**42.8**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH ≤ 6.0	**0 out of 10 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH ≥ 9.0	**0 out of 10 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >234 µg/L	**1 out of 10 discharge days**	**>234 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100ml	**1 out of 3 discharge months**	**400/ml**

Note:
[a] Compliance assessed over a 5-year average.
Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

The annual TSS removal was calculated to be 42.8 percent, which did not meet its annual average TSS removal permit level of 50 percent. The annual event average SS was 0.09 ml/L/hr., and therefore met the annual average NPDES permit level of 0.3 ml/L/hr.

Solids removal at Alki WWTS has not met the 50 percent limit in the past and past operational changes to improve the removal was not effective in 2016. These changes included changing the set point to start the solids flights in the sedimentary tanks earlier as the sedimentary tanks fill so that as solids settle the flights will move the solids to the sump to be removed sooner and avoid any potential solid wash out or carry over to the effluent flow. In addition, King County operators cleaned out and removed accumulated solids and debris from the effluent channel as part of the summer dry weather work. High rates of flow and swings of inflows from 63rd pump station can impact solids removal. Recently, pump variable frequency drives (VFDs) where added to all three CSO pumps at 63rd pump station as part of the capital project to improve flow control into Alki WWTS. Monitoring and fine-tuning of the pump controls is ongoing by the contractor and by King County staff. The final evaluation and analysis should be available after the 2017 wet season. As part of the CSO control program, King County brought in consultants in early 2016 to evaluate plant performance and make recommendations on how to improve solids removal. The consultant review and recommendations should be available by 2018.

Fecal Coliform Bacteria

In 2016 the maximum monthly geomean value for the fecal coliform was 733 counts/100 ml occurring in October; thereby not meeting the NPDES permit's monthly limit for geomean of 400 counts/100 ml for that month. The remaining discharge months met the fecal coliform monthly geomean. The high fecal coliform values during the October 13 discharge event resulted in the high geomean for the month. The station received inflows with high solids and subsequent inflow and discharge events occurred before King County staff had the opportunity to hose down and wash out the excess solids. These solids contributed to high fecal coliform values in the effluent samples. The station is now prepared for the next storm event by staff shortly after each individual event to avoid interference of solids from the previous event. The annual average of the monthly fecal coliform geomean was 248 counts.

Total Residual Chlorine

The maximum daily average effluent TRC during 2016 was 362 µg/L which is above the permit limit of 234 µg/L. The high TRC for that discharge day occurred on October 13, a very short discharge day (0.12 hours of discharge). The pre-dechlorination sample pump that provides samples to the pre-dechlorination chlorine analyzer failed to start soon enough for the SBS feed program to control the SBS feed pumps, and in turn resulted in under dosing of SBS and caused the high daily average TRC. The sample pump has been modified to start quicker. The annual TRC average was 43 µg/L.

Instantaneous Minimum and Maximum Effluent pH

The daily instantaneous minimum and maximum pH during the 2016 reporting year was 6.2 and 7.3, respectively, which met the NPDES permit limits for both daily instantaneous pH minimum equal to or greater than 6.0 and the maximum pH equal to or less than 9.0.

Operation and Maintenance

There were major upgrades made by King County staff in past years; staff evaluated and made adjustments as needed. Highlights of O&M activities during 2016 include:

- Conducted annual CSO refresher training for the operators in September 2016.
- Received shipments of both sodium hypochlorite and sodium bisulfite (SBS) treatment chemicals.
- Evaluated and made adjustments to the completed improvements to the influent sampling system.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.

- Cleaned out the effluent channel of accumulated solids and debris to improve solids removal and reduce any biological regrowth to improve the disinfection process.
- Continued quarterly testing the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Continued a preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.
- Continued to monitor and evaluated the new dechlorination system improvement.

Hypochlorite Feed System Improvement Project

A project was initiated in 2016 to improve the hypochlorite feed system at Alki WWTS. This project is scheduled to be completed by fall 2017 and is necessary to replace the aging pumps and chemical piping. The project includes replacement of the old oversized hypochlorite feed pumps with three new magnetic drive metering pumps along with associated VFDs and two chemical feed flow meters. New hypochlorite feed piping and venting is included in the project. In a separate project also initiated in 2016, the chemical offloading station is scheduled for upgrade in fall 2017. This project will design and construct an improved chemical containment area for bulk hypochlorite offloading at Alki.

Near Future Operation

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

- Continue to evaluate and make any necessary adjustments to the dechlorination system as part of the Dechlorination System Improvement Project.
- Continue with the evaluation, testing and adjustments of the new Variable Frequency Drives for the 63rd Street pumps.
- Ongoing support of the project design for a hypochlorite feed system, including three new feed pumps and flow meters.
- Follow up and review consultant recommendations to improve Alki CSO treatment performance.

Table C-2. Alki WWTS Annual Event Data Summary

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
January	13	1	0.63	0	0.00	694	227		ND		ND	ND	
	21	2	31.60	1	28.32	25,564	15,064		0.10		130/ 0	0	6.2/ 6.9
	22	2	2.19	1	2.19	822	1,184		0.10	0.1	40	0	6.8/ 6.9
	23	2	0.94	0	0.00	564	174		ND		ND	ND	ND
	27	3	12.07	2	9.23	3,423	2,381		0.10		0/ 0	0	6.3/ 6.7
	28	3	7.75	2	6.34	3,102	1,161		0.10	0.1	ND	0	6.5/ 6.8
	Instant. Min/Max pH												**6.2/6.9**
	Event/Daily Max									**0.10**		**0**	
	Monthly Total/Avg/GeoMean	**3**	**55.18**	**2**	**46.08**	**34,169**	**20,190**	**41%**			**6**		
February	11	1	1.36	ND	ND	1,974	106						
	12	1	0.67	ND	ND	1,051	138						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**2.03**	**0**	**0.0**	**3,024**	**244**	**92%**			**ND**		
March	9	1	10.56	1	8.00	5,460	3,909		0.00		20/ 0	0	6.2/ 7.3
	10	1	0.81	1	0.81	453	212		0.10	0.05		0	7.3/ 7.3
	13	2	0.49	0	0.00	143	20		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**6.2/ 7.3**
	Event/Daily Max									**0.05**		**0**	
	Monthly Total/Avg/GeoMean	**2**	**11.86**	**1**	**8.81**	**6,056**	**4,141**	**32%**			**4**		
April	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	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	0	ND	ND	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	0	ND	ND	ND	ND			ND		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												ND

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**ND**	**ND**	**ND**			**ND**		
October	13	1	1.90	1	0.10	919	518		0.10		800	**362**	6.7/ 6.9
	14	1	9.25	1	9.25	7,406	5,127		0.10	0.10	2,400	20	6.0/ 6.8
	19	2	0.84	0	0.00	715	28		ND	ND	ND	ND	ND
	20	2	4.34	2	3.02	2,534	1,262		0.10	0.10	500	10	6.3/ 6.8
	26	3	4.95	3	2.75	5,532	3,495		0.10	0.10	300	40	6.4/ 6.6
	Instant. Min/Max pH												**6.0/ 6.9**
	Event/Daily Max									**0.1**		**362**	
	Monthly Total/Avg/GeoMean	**3**	**21.3**	**3**	**15.1**	**17,105**	**10,431**	**39.0%**			**733**		
November	14	1	0.94	0	0.00	956	73		ND	ND	ND	ND	ND
	15	1	0.01	0	0.00	7	2		ND	ND	**ND**	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.95**	**0**	**0.0**	**963**	**75**	**92.2%**			**ND**		
December	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**ND**	**ND**	**ND**			**ND**		
Total		**10**	**91.30**	**6**	**70.01**	**61,317**	**35,081**						
Inst. pH Min/Max													**6.0/7.3**
Max (GEM, SS,										**0.10**	**733**	**362**	

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ Alki + WP (lbs)	Removal (%)	Eff. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
TRC)													
Annual Average							by mass:	42.8%		0.09	248	43.20	

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

	Inflow Volume (MG)	Discharge Volume (MG)	Total TSS Infl. (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	91.3	70.0	61,317	35,081	42.8%	0.10	0.09	733	248	362	6.0/7.3

Appendix D
Carkeek Wet Weather Treatment Station
Annual Report

January–December 2016

Executive Summary

This 2016 report summarizes the performance of Carkeek Wet Weather Treatment Station (Carkeek WWTS). The Carkeek WWTS began to operate as a wet weather treatment station on November 1, 1994. The Carkeek WWTS operates under the NPDES permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1.

The total rainfall for the reporting period was 44.01 inches, as measured by the Ballard Station rain gauge. The annual rainfall recorded at Sea-Tac was 45.18 inches for 2016 compared to the historical annual average measured at Sea-Tac of 39.13 inches.

There were 17 filling events and eight discharge events during 2016. The Carkeek WWTS received 23.4 million gallons (MG) and discharged 17.7 MG. The annual average TSS removal was 49.4 percent for the year thereby not meeting the NPDES permit limit of 50 percent for annual removal. Carkeek WWTS met its annual average SS limit with the average measured as 0.09 milliliters/liter/hour (ml/L/hr.) with the NPDES permit limit being 0.3 ml/L/hr. The Carkeek WWTS met all remaining NPDES permit limits with exception of the one daily total residual chlorine limit.

Performance in 2016

Table D-1 summarizes NPDES permit performance in 2016.

Table D-1. Carkeek WWTS Permit Performance in 2016

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**8**	**10**
Discharge volume million gallons (MG)[a]	**17.7**	**46**
Annual average SS (ml/L/hr)	**0.09**	**0.3**
Annual average TSS removal- including all discharge events (%)	**49.4**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**0 out of 12 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0	**0 out of 12 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC > 490 µg/L	**1 out of 12 discharge days**	**<490 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100ml	**0 out of 4 discharge months**	**400/ml**

Note:
[a] Compliance assessed over a 5-year average.
Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

TSS removal averaged 49.4 percent, thereby not meeting the annual TSS removal NPDES permit limit of 50 percent. One extreme storm on January 21 -23 accounted for nearly 60 percent of the solids discharged for the entire year and this storm event contributed to the low TSS removal for the year. The annual SS for the year averaged 0.09ml/L/hr., thereby meeting the NPDES Permit limits annual average.

Fecal Coliform Bacteria

The maximum monthly geomean during the 2016 reporting period occurred in March and was 11 counts/100 ml, thereby meeting the monthly NPDES permit limit of 400 counts/100ml. The annual average of the monthly geomean was 7 counts/100ml. None of the months with discharges exceeded the NPDES permit limit.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2016 reporting period was 6.5 and 8.2, respectively, thereby meeting the NPDES permit limits for instantaneous minimum pH equal to or greater than 6.0 and for the maximum pH permit limit of equal to or less than 9.0.

Total Residual Chlorine

The maximum daily average effluent TRC during the 2016 reporting year was 512 µg/L, thereby not meeting the NPDES permit limit of 490 µg/L. On November 24, 2016, the duty sodium bisulfite (SBS) feed pump failed to start automatically and the dechlorination system did not dechlorinate resulting in the daily average TRC greater than 490 µg/L. Once the backup feed pump was switched to the duty pump SBS feed was re-established. The failed pump was replaced and the station returned to a lead and backup feed pump configuration. Carkeek met the daily maximum TRC on the remaining discharge days in 2016.

Operation and Maintenance

Carkeek Pumps Station VFD failure occurred in summer 2016 and resulted in having only two pumps set instead of three thus lowering the pump station capacity. This lowered capacity has impacted Carkeek WWTS by causing prolonged CSO flows as illustrated by an exacerbated CSO event during the November 27 event. There were no permit violations as a result of the reduced pump station capacity on the November 27 event. King County staff along with the vendor of the new VFD are monitoring and making adjustments as needed. Highlights of O&M activities during 2016 include:

- Conducted annual CSO refresher training for the operators in October 2016.
- Received shipments of both sodium hypochlorite and SBS treatment chemicals.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Cleaned out the sedimentary tanks and effluent channel of accumulated solids and debris to improve solids removal.
- Continued quarterly testing the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Continued a preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.
- Carkeek Pump Station evaluation and adjustments of the VFD is ongoing.

Near Future Operation

As with all wet weather treatment stations, opportunities to operate and then to optimize are very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. Given the “normal” challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons including:

- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued quarterly testing the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Continued a preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.
- Continued to monitor and evaluated the completed flow measurement improvements.
- Follow up with VFD replacement project for the raw sewage pumps at Carkeek Pump Station.

Table D-2. Carkeek WWTS Annual Plant Performance 2016

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
January	21	1	10.72	1	10.59	3,128	2,897		0.10		20/ 0	10	6.5/ 7.9
	22	1	1.17	1	1.11	575	200		0.10		0	10	6.8/ 6.9
	23	1	0.22	1	0.19	105	52		0.10	0.1	0	10	6.8/ 6.9
	27	2	1.54	2	0.96	731	217		0.10		0	40	6.5/ 6.8
	28	2	1.12	2	1.04	505	226		0.10	0.1	0	10	6.8/ 6.8
	Instant. Min/Max pH												**6.5/ 7.9**
	Event/Daily Max									**0.10**		**40**	
	Monthly Total/Avg/GeoMean	**2**	**14.8**	**2**	**13.89**	**5,044**	**3,593**	**28.8%**			**2**		
February	12	1	0.14	ND	ND	173	23		ND	**ND**	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.1**	**ND**	**ND**	**173**	**23**	**86.9%**	**ND**		**ND**		
March	9	1	0.72	1	0.13	1,365	547		0.01	0.01	130/ 0	20	6.6/ 7.7
	13	2	0.23	ND	0.00	211	30		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**6.6/ 7.7**
	Event/Daily Max									**0.01**		**20**	
	Monthly Total/Avg/GeoMean	**2**	**0.95**	**1**	**0.13**	**1,576**	**577**	**63.4%**			**11**		
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**	**ND**	**ND**			**ND**		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**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**	**ND**	**ND**			**ND**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
September	2	1	0.16	0	0.00	392	17		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.2**	**ND**	**ND**	**392**	**17**	**95.8%**			**ND**		
October	13	1	0.40	0	0.00	685	371		ND	ND	ND	ND	ND
	14	1	0.66	1	0.34	629	339		0.1	0.1	80/ 20	10.0	6.4/ 7.1
	15	1	0.16	0	0.00	129	22		ND	ND	ND	ND	ND
	19	2	0.58	2	0.12	687	42		0.1		-	90.0	6.5/ 8.0
	20	2	0.92	2	0.90	604	271		0.1	0.1	0/ 0	30.0	6.7/ 7.1

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	26	3	1.58	3	0.95	1598	1005		0.1	0.1	20/ 40	140.0	6.7/8.0
	31	4	0.14	0	0.00	182	14		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**6.4/ 7.1**
	Event/Daily Max									**0.1**		**140**	
	Monthly Total/Avg/GeoMean	**4**	**4.43**	**3**	**2.31**	**4,515**	**2,065**	**54.3%**			**10**		
November	1	1	0.11	0	0.0	148	15		ND	ND	ND	ND	ND
	5	2	0.20	0	0.0	334	36		ND	ND	ND	ND	ND
	14	3	0.04	0	0.0	50	4		ND	ND	ND	ND	ND
	24	4	1.54	1	1.04	1015	767.39		0.10	0.1	0/ 0	512	7.0/ 8.2
	26	5	0.28	0	0.0	579	81.08		ND	ND	ND	ND	ND
	27	5	0.65	2	0.31	591	167.44		0.10	0.1	110/ 0	10	7.0/ 7.1
	Instant. Min/Max pH												**7.0/8.2**
	Event/Daily Max									**0.1**		**512**	
	Monthly Total/Avg/GeoMean	**5**	**2.82**	**2**	**1.36**	**2716**	**1071**	**60.6%**			**3**		
December	23	1	0.10	0	0.0	110	25		ND	ND	ND	ND	ND
	26	2	0.08	0	0.0	49	2.51		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.17**	**0**	**0.00**	**160**	**28.0**	**82.5%**			**ND**		
Total		**17**	**23.45**	**8**	**17.68**	**14,576**	**7,373**						
Inst. pH Min/Max													**6.5/8.2**
Max (GEM, SS, TRC)										**0.10**	**11**	**512**	
Annual Average								**49.4%**		**0.09**	**7**	**181**	

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

	Inflow Volume (MG)	Discharge Volume (MG)	Total TSS Infl. (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	23.4	17.68	14,576	7,373	49.4%	0.10	0.09	11	7	512	6.5/8.2

Appendix E
Elliott West Wet Weather Treatment Station
Annual Report

January–December 2016

Executive Summary

This 2016 annual report summarizes the performance of the Elliott West Wet Weather Treatment Station (EW WWTS). Elliott West WWTS 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 permit went into effect on February 1, 2015.

Total rainfall recorded in 2016 was 38.64 inches as measured at the Denny Way rain gauge station which is located at 3165 Alaskan Way in Seattle. The annual rainfall recorded at Sea-Tac was 45.18 inches for 2016 compared to the historical annual average measured at Sea-Tac of 39.13 inches.

There were 42 inflow events and nine discharge events in 2016. Elliott West WWTS received a total of 449.4 million gallons (MG) out of which 172.5 MG was treated and discharged through the Elliott West Outfall at the Denny Way Regulator Station located in Myrtle Edwards Park. Over 60 percent of the total discharged CSO volume occurred in October 2016. The average total suspended solids (TSS) removal for all events during the year was 52.8 percent thereby meeting the NPDES 50 percent annual average TSS removal limit. However, EW WWTS did not meet the SS annual event average limit with the average measured as 2.23 milliliters/liter/hour (ml/L/hr.) and the NPDES permit limit being 0.3 ml/L/hr. The performance for 2016 has been summarized below in Table E-1.

Performance in 2016

Table E-1 summarizes NPDES permit performance in 2016.

Table E-1. Elliott West WWTS Permit Performance in 2016

Parameter	Performance	Permit Conditions
Discharge events (number)	**9**	**NA**
Discharge volume million gallons (MG)	**172.5**	**NA**
Annual average SS (ml/L/hr.)	**2.23**	**0.3**
Annual average TSS removal- including all discharge events (%)	**52.8**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**8 out of 15 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0	**0 out of 15 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >109 µg/L	**11 out of 15discharge days**	**<109 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100ml	**1 out of 5 discharge months**	**≤400/ml**

Note:
Numbers in red are permit exceedances.

Suspended and Settleable Solids

In 2016, the annual TSS removal was calculated to be 52.8 percent; therefore it met the NPDES permit limit of 50 percent. The renewed NPDES permit effective February 1, 2015 removed the SS event maximum limit and kept the annual average of 0.3 ml/L/hr. Meeting the SS NPDES permit limit continues to be a challenge. The annual SS concentration for the 2016 discharge events averaged 2.23 ml/L/hr., exceeding the NPDES permit limit of 0.3 ml/L/hr. The event maximum in 2016 was 5.90 ml/L/hr. occurred on February 12, 2016. With the ongoing challenges of meeting the NPDES permit limits, King County has started a project with consultant engineers to help determine the issues with solids removal and SS compliance. An extensive sampling plan has been established to monitor flows and solids entering the Mercer Street Treatment Tunnel and Elliott West WWTS pipeline (wet well inputs from the west flows). The solids sampling and monitoring project started in late 2015 and continued through 2016. The consultants will submit in 2017 recommendations to King County on treatment alternatives to improve solids removal and overall treatment performance at EW WWTS.

Fecal Coliform Bacteria

In 2016, Elliott West WWTS did not meet the fecal coliform NPDES permit limit of 400/100 ml monthly geomean one out of the five discharge months. The maximum monthly geomean for fecal coliform bacteria was calculated as 651 counts/100 ml occurred in the month of October. The annual average of monthly geomeans was 190 counts/100 ml. In 2016, the highest fecal coliform count was 9,000/100 ml, and it occurred during the October 26, 2016 discharge. Corrective action taken throughout the year, such as, cleaning and shock dosing the final effluent sample line and stilling well, and increasing the hypochlorite dose did not have the desired impact on fecal coliform inactivation. Further increases in hypochlorite dose set point

will continue for future events; however, with increased in hypochlorite dose and chlorine residual and the subsequent increase in dechlorination there is an increased risk of exceeding the minimum pH limit. Additional steps to improve fecal coliform inactivation include review of the hypochlorite and dechlorination chemical feed system pumps and program controls as part of the 2016 Elliott West WWTS assessment and improvement project by King County.

Total Residual Chlorine

During 2016, there were 11 discharge days out of 15 that exceeded the maximum daily average total residual chlorine (TRC) NPDES permit level of 109 µg/ml. Please refer to Table E-2 for the discharge events that have exceeded the TRC limits. The annual average of all daily TRC values was 438 µg/ml and the maximum value of 1248 µg/ml was measured by the online effluent chlorine analyzer. There are several potential causes for the TRC permit limit exceedances. Several of the discharge events had intermittent flows and many events had wide pumping fluctuations by the main pumps causing challenges to the chemical systems to respond quickly enough to the changes in the discharge flows. In addition, the TRC exceedances may have been caused by inadequate sodium bisulfite (SBS) feed and mixing and the continuous adjustments made to the SBS feed in direct response to the minimum pH excursions. It is possible that SBS under feeding contributed to the TRC exceedances. From examining event data trends, it is possible 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. During most events, one or both of the SBS induction mixers tend to trip out and requires manual reset due to motor overload caused by heavy debris and floatables fouling the mixer propeller. With limited mixing by the induction mixers, the effectiveness of the dechlorination system is severely impacted resulting in high chlorine residual in the effluent and at times violating the daily average TRC limits. WTD staff is continuing to adjust the chemical feed controls as well as the monitoring equipment (i.e., the online chlorine analyzers and pH meter). In 2016, a capital project was initiated to build a separate dedicated sampling and instrumentation room at Denny Station for the final effluent compliance sampling and monitoring and pre-dechlorination sample delivery improvements. This project includes increased capacity of the C2 water system to attain higher flows of SBS carrier water. A modified dechlorination control program has been added in 2016 to allow operators to switch between automatic SBS feed control to “semi-auto” feed control. In semi-auto feed control, the inputs from the pre-dechlorination chlorine analyzer are disengaged, requiring the operator to enter a pre-dechlorination chlorine residual value. The pre-dechlorination chlorine analyzer provides a control input for the dechlorination feed program frequently becomes clogged, thus, generating false chlorine residual inputs to the SBS feed program and resulting in incorrect dosing of SBS. Furthermore, design of a diffuser for SBS application was submitted and will be installed in summer 2017. Evaluation of the diffuser will start shortly after installation. Along with work on the SBS diffuser, King County has implemented a project to design, install and operate a post – inline SBS dilution system at EW WWTS to dilute the 38 percent SBS to 20 percent solution when SBS is transferred to the day tank at Denny Station. Using a more dilute SBS along with additional carrier water will aid in chemical dispersion and improved mixing. The SBS post-dilution system will be installed by summer 2017.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum and maximum effluent pH in 2016 was measured as 5.5 and 7.9, respectively. There were a total of 15 discharge days in 2016, and eight of those discharge days had the instantaneous minimum effluent pH measured below the NPDES permit level of 6.0, while there were no events exceeding the maximum pH limit of 9.0. Typically, a drop in the effluent pH during discharge and treatment indicates a potential overdosing of SBS or overdosing of sodium hypochlorite, along with low alkalinity of the CSO flows. The dechlorination reaction with SBS consumes alkalinity, and high pre-dechlor chlorine residual requires additional SBS feed, which in turn results in the consumption of alkalinity. In response to these incidents of depressed effluent pH values, staff has been fine-tuning the SBS feed control program, reducing SBS feed, and reducing hypochlorite feed; however, these actions did not prevent all exceedances in 2016.

The alkalinities of the inflow and final effluents have been determined to be in the range 12 to 40 milligrams per liter as CaCO3. These very low alkalinity values are contributing to the pH challenges. From the data collection during discharges, it has been suggested that the low alkalinity values measured from the inflows at Elliott West WWTS, along with high hypochlorite feed, were causing the dechlorination reaction to consume alkalinity and to cause the pH depression in the final effluent. WTD staff will continue to respond to Elliott West WWTS discharges in order to adjust the chlorination and dechlorination controls. Some projects to improve treatment chemical feed controls and SBS mixing mentioned in the previous section on final chlorine residual permit performance will also benefit in meeting the pH permit limits of the discharge effluents. Further analysis of the data trends of discharge events is ongoing.

Operation and Maintenance

Highlights of O&M activities at EW CSO during 2016:

- Conducted annual CSO refresher training for the operators in August and September 2016.
- Continued to provide an on-site response team in anticipation of a treatment and discharge event, and during the event. The members of the multi-disciplinary response team work together to troubleshoot and fine-tune the chlorination-dechlorination feed controls, sampling, and process control.
- Received shipments of both sodium hypochlorite and SBS treatment chemicals as needed.
- Continued the automated Mercer Tunnel flushing program at the East Portal flushing gate as an attempt to flush and capture the solids settled in the Mercer Tunnel.
- Continue to monitor the effectiveness of the automated Mercer Tunnel flushing by taking additional samples from the return flows and running laboratory solids analyses on the those samples.
- Continued to run the dewatering pumps during discharges in order to remove additional solids, which takes advantage of the turbulence and re-suspension of solids in the wet well caused by the larger main pumps and increases the amount of solids in the return

flows to the West Point Treatment Plant.

- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued with additional procedures to the post-discharge event routines including equipment testing, cleaning and de-ragging within the dechlor and final effluent vaults/structures. Equipment includes both pre-dechlor and final effluent sample pumps and sample intakes and SBS mixers.
- Continued to exercise the chemical feed pumps on a monthly basis as a preventive maintenance measure.
- Continued quarterly or monthly testing the treatment chemicals strength concentration (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Made changes to main pump control program with the goal to minimize large pump flow swings impacting treatment and impacts to upstream conveyance.
- In 2016 a design of a diffuser for SBS application was submitted and will be installed in summer 2017. Evaluation of the diffuser will start shortly after installation.
- King County in 2016 has implemented a project to design, install and operate a post – inline SBS dilution system at EW WWTS to dilute the 38 percent SBS to 20 percent solution. The SBS post-dilution system will be implemented by summer 2017.
- Implemented “semi-auto” mode for SBS feed control when engaged disables input from the pre-dechlorination chlorine analyzer to the SBS feed program during times when the analyzer is not working properly.

Chlorination-Dechlorination System Improvements Project

2016 marks the fifth year of operation for the chlorination-dechlorination system controls, part of the Chlorination-Dechlorination System Improvement Project. This project was completed in November 2011. The response team was tasked with troubleshooting and adjusting the feed controls, and they responded to each treatment and discharge event when the wet well was filling, prior to the start of the main discharge pumps. It was decided to switch to Mode 3 for hypochlorite feed. Use of Mode 3 allows for better hypochlorite feed control which should reduce the potential of over feeding of hypochlorite, and therefore, could also reduce the over feeding of SBS. To adjust the new system, station performance was evaluated during the operations debriefing held after each discharge event. An example of evaluation and continuous improvement is the modification to the SBS feed control was implemented in early 2016 as the “semi-auto” mode. When the mode is employed by the operator, the program disengages inputs from the pre-dechlorination chlorine analyzer to the feed program and the operator inputs value for the pre-dechlorination chlorine residual, thus removing inaccurate inputs to the dechlorination program. The pre-dechlorination chlorine analyzer becomes clogged and unreliable outputs occur often during discharge events. This modification was implemented to minimize underfeeding of SBS and subsequent high effluent chlorine residual. This continuous improvement process is ongoing.

Other Improvement Projects at Elliott West Wet Weather Station

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

In a separate project, the SBS post-dilution system, was started in 2016 and will be completed in 2017. This project will dilute the SBS from the stored concentration of 38 percent to 20 percent solution during the transfer of SBS from storage tanks at Elliott West facility to the day tank at Denny Station. Use of a more dilute SBS will minimize freezing and crystallization of SBS in the transfer line and will aid in SBS dispersion at dechlorination vault located at Denny Station. It is anticipated that the SBS feed pumps will perform better when pumping at higher speeds to adjust for a more dilute SBS chemical.

Near Future Operation

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

In early 2016, King County hired a consultant engineering team to address issues of solids capture and removal, screenings of CSO flows, and to improve compliance at EW WWTS. Results of this work will be completed by the end of 2018.

In addition, WTD staff will:

- Continue to investigate and correct the cause(s) of the instantaneous minimum pH exceedances.

- Continue to implement the response team to Elliott West WWTS as the wet well fills and in anticipation of a discharge.
- Continue evaluation and fine-tuning of the chlorination and dechlorination controls.
- Implement the project to relocate instrumentation and sampling equipment into a separate room out of the SBS day tank room. Staff will continue to provide project support throughout the implementation, construction and commissioning phases of the project.
- Continue to sample and monitor copper and dissolved oxygen of Elliott West WWTS flow per NPDES permit requirement.
- Continue with laboratory solids analyses on all flows sampled at Elliott West WWTS as part of the monitoring of the automated Mercer Tunnel flushing program.
- The SBS post-dilution system will be implemented by summer 2017 and fine-tuning will occur as necessary.
- Continue evaluation and fine-tuning of changes in the main pump control program.

Table E-2. Elliott West Annual Plant Performance 2016

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
January	7	1	0.26	0	0.00	320	12		ND	ND	ND	ND	ND
	12	2	3.29	0	0.00	1,825	377		ND	ND	ND	ND	ND
	13	2	6.16	0	0.00	1,367	446		ND	ND	ND	ND	ND
	14	2	0.74	0	0.00	1,427	104		ND	ND	ND	ND	ND
	15	2	0.09	0	0.00	142	9		ND	ND	ND	ND	ND
	16	2	3.73	0	0.00	1,604	317		ND	ND	ND	ND	ND
	17	2	2.86	0	0.00	707	82		ND	ND	ND	ND	ND
	19	3	4.78	0	0.00	822	88		ND	ND	ND	ND	ND
	20	3	1.94	0	0.00	5,973	417		ND	ND	ND	ND	ND
	21	3	31.15	1	28.53	6,452	6,154		0.10		800/ 270/ 0	571	5.9/ 7.9
	22	3	7.62	1	0.65	2,046	991		0.40	0.25	-	0	6.7/ 6.9
	23	3	6.55	0	0.00	1,318	405		ND	ND	ND	ND	ND
	24	3	1.86	0	0.00	1,491	242		ND	ND	ND	ND	ND
	26	4	0.71	0	0.00	1,915	141		ND	ND	ND	ND	ND
	27	4	10.17	2	8.86	6,576	6,059		1.50		500/ 0	512	5.7/ 7.3
	28	4	7.98	2	1.02	6,719	2,435		1.50	1.5	-	72	6.0/ 6.6
	29	4	2.31	0	0.00	1,001	140		ND	ND	ND	ND	ND
	30	4	0.61	0	0.00	947	69		ND	ND	ND	ND	ND
	31	4	1.71	0	0.00	6,902	454		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**5.7/ 7.9**
	Event/Daily Max									**1.50**		**571**	
	Monthly Total/Avg/GeoMean	**4**	**94.52**	**2**	**39.06**	**49,552**	**18,941**	**62%**			**40.4**		
February	1	1	1.44	0	0.00	1,234	59		ND	ND	ND	ND	ND
	3	2	1.89	0	0.00	540	27		ND	ND	ND	ND	ND
	4	2	1.36	0	0.00	1,137	71		ND	ND	ND	ND	ND
	5	2	0.49	0	0.00	892	47		ND	ND	ND	ND	ND
	10	3	1.97	0	0.00	1,876	115		ND	ND	ND	ND	ND
	11	3	2.40	1	0.98	15,068	1,197		2.8		220	NM	5.9/ 7.9
	12	3	11.01	1	6.16	14,165	11,678		9.0	5.90	40	622	5.5/ 7.8

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	13	3	3.47	0	0.00	958	57		ND	ND	ND	ND	ND
	14	3	0.73	0	0.00	32,132	1,627		ND	ND	ND	ND	ND
	17	4	1.12	0	0.00	599	38		ND	ND	ND	ND	ND
	18	4	3.79	0	0.00	545	40		ND	ND	ND	ND	ND
	19	4	1.58	0	0.00	2,833	218		ND	ND	ND	ND	ND
	28	5	1.17	0	0.00	1,058	48		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**5.5/7.9**
	Event/Daily Max									**5.9**		**622**	
	Monthly Total/Avg/GeoMean	**5**	**32.44**	**1**	**7.14**	**73,037**	**15,222**	**79%**			**94**		
March	1	1	2.26	0	0.00	1,075	100		ND	ND	ND	ND	ND
	2	1	1.54	0	0.00	615	39		ND	ND	ND	ND	ND
	4	2	0.63	0	0.00	692	35		ND	ND	ND	ND	ND
	5	2	0.28	0	0.00	501	38		ND	ND	ND	ND	ND
	6	2	1.55	0	0.00	387	76		ND	ND	ND	ND	ND
	7	2	2.13	0	0.00	392	64		ND	ND	ND	ND	ND
	9	3	8.24	1	6.25	3,647	3,392		0.00	0.00	0/ 0	594	6.1/ 7.7
	10	3	6.32	0	0.00	1,427	272		ND	ND	ND	ND	ND
	11	3	2.39	0	0.00	5,688	853		ND	ND	ND	ND	ND
	12	3	0.98	0	0.00	646	80		ND	ND	ND	ND	ND
	13	3	3.01	0	0.00	686	98		ND	ND	ND	ND	ND
	14	3	0.84	0	0.00	1,061	69		ND	ND	ND	ND	ND
	19	4	0.25	0	0.00	613	19		ND	ND	ND	ND	ND
	26	5	0.32	0	0.00	314	11		ND	ND	ND	ND	ND
	27	5	1.99	0	0.00	14,640	710		ND	ND	ND	ND	ND

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	Instant. Min/Max pH												**6.1/ 7.7**
	Event/Daily Max									**0.0**		**594**	
	Monthly Total/Avg/GeoMean	**5**	**32.74**	**1**	**6.25**	**32,383**	**5,856**	**82%**			**1.0**		
April	3	1	0.35	0	0.0	124.3	4.5		ND	ND	ND	ND	ND
	4	1	0.18	0	0.0	523.4	22.8		ND	ND	ND	ND	ND
	12	2	1.24	0	0.0	487.3	23.8		ND	ND	ND	ND	ND
	13	2	0.64	0	0.0	386.6	21.9		ND	ND	ND	ND	ND
	24	3	3.81	0	0.0	2,923.7	142.9		ND	ND	ND	ND	ND
	25	3	0.94	0	0.0	2,451.2	114.5		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**7.17**	**ND**	**ND**	**6,897**	**330**	**95%**			**ND**		
May	18	1	0.33	0	0.0	3,009	65		ND	ND	ND	ND	ND
	19	1	1.45	0	0.0	1,125	37		ND	ND	ND	ND	ND
	21	2	0.34	0	0.0	29	1		ND	ND	ND	ND	ND
	26	3	0.20	0	0.0	247	9		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**2.33**	**ND**	**ND**	**4,410**	**112**	**97%**		**ND**	**ND**		
June	13	1	0.29	0	0.0	195	7		ND	ND	ND	ND	ND
	20	2	1.15	0	0.0	467	12		ND	ND	ND	ND	ND
	21	2	1.41	0	0.0	1,129	64		ND	ND	ND	ND	ND
	23	3	0.89	0	0.0	544	18		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**3**	3.74	**ND**	**ND**	**2,335**	**102**	**96%**			**ND**		
July	4	1	0.26	0	0.0	1,339	43		ND	ND	ND	ND	ND
	22	2	0.57	0	0.0	372	18		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.83**	**ND**	**ND**	**1711**	**60**	**96%**			**ND**		
August	No inflow/discharge												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**ND**	**-**	**-**	**ND**			**ND**		
September	2	1	3.15	0	0.00	1,255	53		ND	ND	ND	ND	ND
	17	2	0.27	0	0.00	1,124	28		ND	ND	ND	ND	ND
	19	3	0.34	0	0.00	120	3		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**3.76**	**ND**	**ND**	**2,500**	**84**	**97%**			**ND**		
October	1	1	0.50	0	0.00	522	14		ND	ND	ND	ND	ND
	6	2	0.36	0	0.00	229	6		ND	ND	ND	ND	ND
	7	2	0.75	0	0.00	577	228		ND	ND	ND	ND	ND
	8	2	0.93	0	0.00	704	283		ND	ND	ND	ND	ND
	9	2	0.86	0	0.00	236	118		ND	ND	ND	ND	ND
	10	2	0.10	0	0.00	29	2		ND	ND	ND	ND	ND
	12	3	0.07	0	0.00	173	4		ND	ND	ND	ND	ND
	13	3	29.03	1	26.05	55,973	52,820		3.00		20/ 800	410	6.1/ 7.9
	14	3	40.14	1	32.10	44,958	40,855		1.60	2.3	1,700	728	6.0/ 7.5
	15	3	11.44	0	0.00	4,096	712		ND	ND	ND	ND	ND

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	16	3	2.50	0	0.00	584	46		ND	ND	ND	ND	ND
	17	3	0.37	0	0.00	1,341	72		ND	ND	ND	ND	ND
	19	4	9.97	2	9.33	2,704	1,677		0.1		-	388	5.9/ 7.2
	20	4	22.57	2	13.47	16,564	6,949		0.1	**0.1**	800/ 230	216	5.7/ 6.5
	21	4	1.11	0	0.00	360	11		ND	ND	ND	ND	ND
	24	5	0.37	0	0.00	316	13		ND	ND	ND	ND	ND
	26	6	35.58	3	23.00	24,130	22,183		4.5	**4.5**	1100/ 9000	1,248	6.2/ 7.8
	27	6	2.41	0	0.00	7,769	971		ND	ND	ND	ND	ND
	29	7	0.36	0	0.00	2,772	165		ND	ND	ND	ND	ND
	31	8	9.86	0	0.00	1,938	154		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**5.7/ 7.9**
	Event/Daily Max									**4.5**		**1248**	
	Monthly Total/Avg/GeoMean	**8**	**169.27**	**3**	**103.95**	**165,975**	**127,283**	**23%**			**651**		
November	1	1	3.74	0	0.00	1,343	136		ND	ND	ND	ND	ND
	2	1	2.17	0	0.00	725	55		ND	ND	ND	ND	ND
	3	1	0.71	0	0.00	4,464	259		ND	ND	ND	ND	ND
	5	2	15.38	0	0.00	4,249	459		ND	ND	ND	ND	ND
	6	2	1.26	0	0.00	63	5		ND	ND	ND	ND	ND
	9	3	0.23	0	0.00	14,926	781		ND	ND	ND	ND	ND
	13	4	0.20	0	0.00	512	30		ND	ND	ND	ND	ND
	14	4	7.80	1	7.26	13,138	11,293		4.0		500	557	5.7/ 7.1
	15	4	11.34	1	0.83	4,042	2,274		4.0	4.0	0	0	6.0/ 6.1
	16	4	1.21	0	0.00	875	136		ND	ND	ND	ND	ND
	20	5	0.28	0	0.00	287	20		ND	ND	ND	ND	ND
	22	6	8.46	0	0.00	3,163	366		ND	ND	ND	ND	ND
	23	6	2.37	0	0.00	252	95		ND	ND	ND	ND	ND
	24	6	25.89	2	7.99	7,140	6,360		1.5	1.5	1300/ 1100	208	5.6/ 6.7
	25	6	2.22	0	0.00	2,947	677		ND	ND	ND	ND	ND
	26	6	3.60	0	0.00	650	91		ND	ND	ND	ND	ND
	27	6	3.97	0	0.00	773	131		ND	ND	ND	ND	ND
	28	6	0.60	0	0.00	202	17		ND	ND	ND	ND	ND

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MGD)	Discharge Event Number	Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Average (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
	29	6	0.31	0	0.00	115	7		ND	ND	ND	ND	ND
	30	6	0.24	0	0.00	88	6		ND	ND	ND	ND	ND
	Instant. Min/Max pH												5.6/ 7.1
	Event/Daily Max									4.0		557	
	Monthly Total/Avg/GeoMean	6	91.98	2	16.08	59,953	23,197	61%			164		
December	4	1	0.31	0	0.0	329.9	19.0		ND	ND	ND	ND	ND
	5	1	0.29	0	0.0	2220.3	142.8		ND	ND	ND	ND	ND
	9	2	0.36	0	0.0	429.9	17.5		ND	ND	ND	ND	ND
	10	2	0.90	0	0.0	645.4	51.8		ND	ND	ND	ND	ND
	19	3	1.22	0	0.0	611.1	33.9		ND	ND	ND	ND	ND
	22	4	0.81	0	0.0	237.1	5.6		ND	ND	ND	ND	ND
	23	4	5.58	0	0.0	1324.9	305.7		ND	ND	ND	ND	ND
	26	5	0.62	0	0.0	263.2	13.3		ND	ND	ND	ND	ND
	27	5	0.07	0	0.0	1496.3	103.2		ND	ND	ND	ND	ND
	31	6	0.48	0	0.0	244.1	11.8		ND	ND	ND	ND	ND
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	6	10.65	0	0.0	7,802	705	91.0%			ND		
Total		42	449.43	9	172.48	406,555	191,891						
Inst. pH Min/Max													5.5/7.9
Max (GEM, SS, TRC)										5.90	651	1248	
Annual Average								52.8%		2.23	189.9	438	

Notes:

* NM= Not measured due to the FE sample pump failed to collect sample.

Red= NPDES permit exceedance

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total TSS Infl. (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	449.4	172.5	406,555	191,891	0.53	5.90	2.23	651	190	1248	5.5/7.9

Appendix F
Henderson/MLK Jr. Way Wet Weather Treatment Station Annual Report

January–December 2016

Executive Summary

This 2016 annual report summarizes the performance of King County's Henderson/Martin Luther King Junior Way Wet Weather Treatment Station (Henderson/MLK Jr. Way WWTS). The Henderson/MLK Jr. Way WWTS came online in 2005 and operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

A total of 42.41 inches of rain fell in 2016 as measured at Henderson Street Pump Station. Sea-Tac recorded 45.18 inches for 2016 compared to the historical annual average measured at Sea-Tac of 37.49 inches (20-year average).

There were four filling events and no discharge events during 2016. The Henderson/MLK Jr. Way WWTS received a total inflow of 3.30 MG and discharged 0 MG of treated water through the Norfolk Street Overflow to the Duwamish Waterway. The Henderson/MLK Jr. Way WWTS operated well in 2016. All NPDES permit performance conditions were met.

Performance in 2016

Table F-1 summarizes NPDES permit performance in 2016.

Table F-1. Henderson/MLK Jr. Way WWTS Permit Performance in 2016

Parameter	Performance	Permit Conditions
Annual average SS (ml/L/hr)	NA	**0.3**
Annual average TSS removal- including all discharge events (%)	74	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH ≤ 6.0	0 out of 0 discharge days	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH ≥ 9.0	0 out of 0 discharge days	**≤ 9.0**
Total residual chlorine, maximum of daily averages (µg/L), frequency of discharge days with TRC > 39 µg/L	0 out of 0 discharge days	**39**
Monthly fecal coliform geomean (#/100 mL), frequency of months with monthly geomean >400/100ml	0 out of 0 discharge days	400

Note:
Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

TSS removal averaged 74 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent.

Fecal Coliform Bacteria

There were no discharge events.

Instantaneous Minimum/Maximum pH

There were no discharge events.

Total Residual Chlorine

There were no discharge events.

Operation and Maintenance

The equipment and facilities of the Henderson/MLK Jr. Way WWTS were fully functioning and available during 2016. 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.

Henderson/MLK Jr. Way WWTS Improvements Project

In 2015, a consultant study recommended improvements to address problems associated with consistently meeting NPDES permit requirements for disinfection and dechlorination. In 2016, a capital project was started to begin improvements based on the consultant's recommendations. An initial set of improvements was designed by the end of 2016. The objective of this set of improvements, listed below, is to increase the accuracy of flow measurements at both the Henderson/MLK Jr. Way Tunnel Inlet RS and Henderson/MLK Jr. Way Tunnel Outlet RS.

- Re-level the tunnel influent and effluent weirs to match the design elevations and PLC programming.
- Add fine-range bubbler sensors near the tunnel influent and effluent weirs, and add bubbler control panels.
- Add chemical flow meters on the sodium hypochlorite and sodium bisulfite (SBS) discharge lines to directly measure chemical flow rates.
- Modify pipe venting to allow the sodium hypochlorite line to drain freely and to eliminate gas binding at high points.
- Install a bubbler access hatch at the Henderson/MLK Jr. Way Tunnel Outlet RS.

Near Future Operation

Construction of the improvements designed in 2016 will begin in 2017.

The design for a second set of capital improvements will begin in 2017. Its objective is to improve chemical dosage control and building safety. The planned engineering design work includes (and may not be limited to) the following:

- Modify the sodium hypochlorite and SBS metering pumps.
- Add a chlorine residual analyzer (with feed forward programming) upstream of the tunnel effluent overflow weirs.
- Modify the SBS chemical room exhaust duct if needed to improve building ventilation.

As with all wet weather treatment stations, opportunities to observe wet weather operations and then optimize are very limited. Challenges may be identified during an event in a wet season, but any major improvements to address the challenge would first need to be planned, designed and implemented; then, opportunities to test and monitor the improvements would occur during the following wet season.

Given the complexity and “normal” challenges of an intermittently-operated WWTS facility, WTD staff will continue to monitor, evaluate, and make necessary adjustments in the station’s operation and maintenance. Similarly, equipment improvements will follow a design-construct-operate-monitor-adjust cycle. Additional improvements will be made as necessary.

Table F-2. Henderson/MLK Jr. Way WWTS Annual Plant Performance 2016

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ MLK + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (avg) (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
January	No Inflow/No Disch.												
21	Instant. Min/Max pH	1	0.3			141	7						**ND**
27		2	1.4			324	94						
28		2	0.8			427	124						
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**2.6**	**ND**	**0.00**	**892**	**225**	**74.8%**	**ND**		**ND**		
February									ND	**ND**	ND	ND	ND
	Instant. Min/Max pH												
	Event/Daily Max												
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.0**				**ND**	**ND**	**ND**	**ND**	**ND**
March		0											
	Instant. Min/Max pH												
	Event/Daily Max												
	Monthly Total/Avg/GeoMean	**1**	**0.00**	**ND**	**0.00**					**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**		

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ MLK + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (avg) (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
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	0.0	ND	ND						ND		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	ND	ND						ND		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	ND	ND						ND		
October	No Inflow/No Disch.												

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effl. TSS Discharged @ MLK + WP (lbs)	Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (avg) (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
14	Instant. Min/Max pH	1	0.15			135	7						ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**1**	**0.2**	**ND**	**ND**	**135**	**7**	**94.8%**			**ND**		
November	15	1	0.55	ND	ND	349	126		ND				
	Instant. Min/Max pH												ND
	Event/Daily Max									**<0.1**		**36**	
	Monthly Total/Avg/GeoMean	**1**	**0.55**	**ND**	**ND**	**349**	**126**	**63.9%**			**2**	**36**	
December	No Inflow/No Disch.								ND				**ND**
	Instant. Min/Max pH												
	Event/Daily Max												
	Monthly Total/Avg/GeoMean	**1**	**0.00**	**ND**	**ND**	**0**	**0.0**						
Total		**4**	**3.30**	**0**	**ND**	**1,376**	**358**						
Inst. pH Min/Max													
Max (GEM, SS, TRC)													
Annual Average								**74.0%**					

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

	Inflow Volume (MG)	Discharge Volume (MG)	Total TSS Infl (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	3.3	0.00	1,376	358	74.0%						