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July 24, 2023

VIA ELECTRONIC SUBMITTAL

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RE: Consent Decree, Civil Action No. 2:13-cv-00677-JCC - King County 2022 Combined Sewer Overflow (CSO) Control Program Consolidated Annual Consent Decree and NPDES Reports

Dear Sir/Madam:

In accordance with the reporting requirements in Section VIII of the Consent Decree, Civil Action No. 2:13-cv-00677-JCC, enclosed is King County's CSO Control Program Consent Decree Annual Report, dated July 2023. The 2022 Annual Report addresses the County's CSO control project and compliance activities from January through December 2022.

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 2022.

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 agreement of the U.S. Environmental Protection Agency and Washington State Department of Ecology, these reports respond to the reporting requirements of the Consent Decree (§ VIII, paragraph 43), WAC, and NPDES permit in a single document.

Thank you for your review of the King County 2022 Annual CSO and Consent Decree Reports. If you have any questions or would like additional information, please contact me at 206-549-1190 or kgurol@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.

DocuSigned by:
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7/24/2023

Kamuron Gurol, Division 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, NDPES Permit Administrator, Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Susan Kaufman-Una, Project Resources Unit Manager, WTD, DNRP
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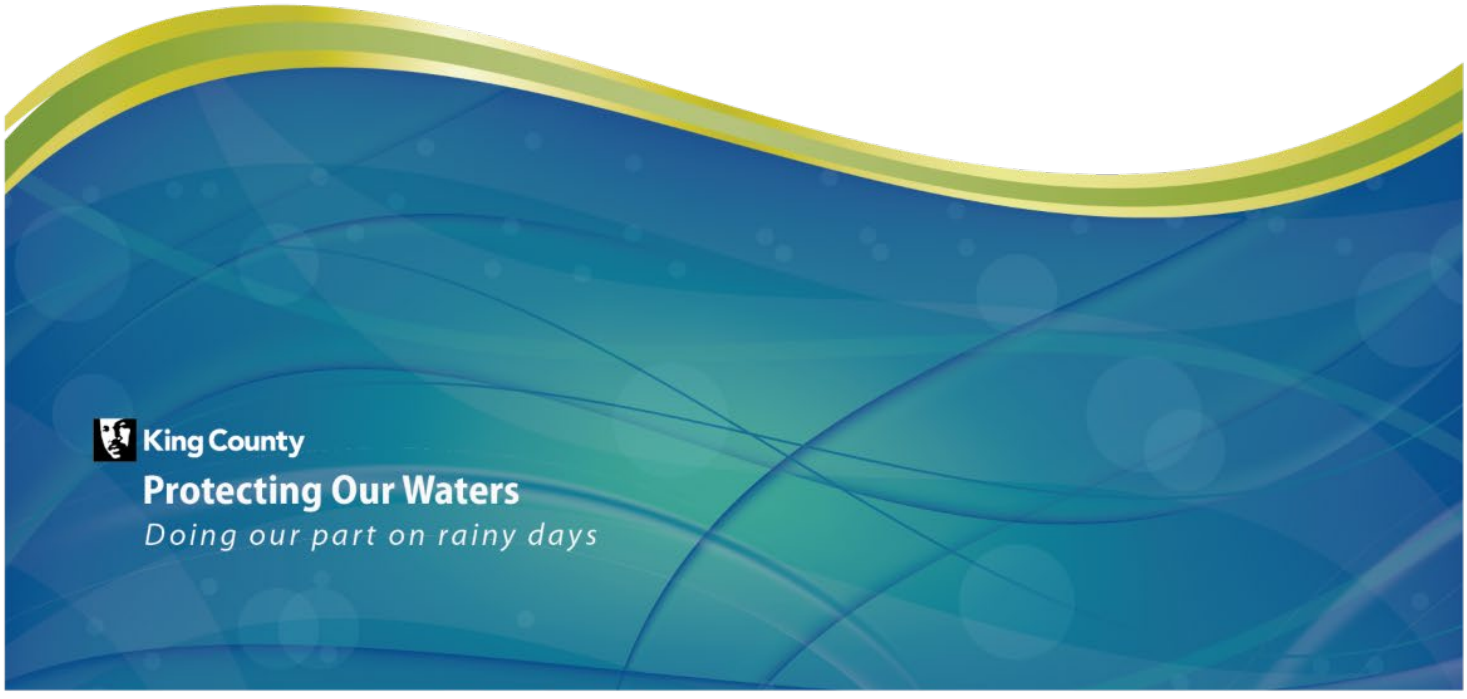
Edward Kowalski, Director, Enforcement and Compliance Assurance Division, U.S. Environmental Protection Agency
Shawn McKone, Municipal Unit Supervisor, Washington State Department of Ecology

Combined Sewer Overflow Control Program

2022 Annual CSO and Consent Decree Report

July 2023



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List of Abbreviations and Acronyms

ARV	air relief valve
BMPs	best management practices
CD	consent decree
Seattle	City of Seattle
County	King County
CSO	combined sewer overflow
DNRP	Department of Natural Resources and Parks
DOJ	Department of Justice
DSN	discharge serial number
DWO	dry weather overflow
eCSO	exacerbated combined sewer overflow
EPA	U.S. Environmental Protection Agency
ERTS	Environmental Report Tracking System
EW	Elliott West
FOG	fats, oils, and grease
ft	foot/feet
GSI	green stormwater infrastructure
HLKK	Hanford/Lander/King/Kingdome
in.	inch(es)
hr	hour
HWMP	Local Hazardous Waste Management Program
JOIST	Joint Operations Information Sharing Team
JOSOP	Joint Operations and System Optimization Plan
JPA	joint project agreement

KCIW	King County Industrial Waste Program
L	liter
LTCP	Long-Term Control Plan
Metro	Municipality of Metropolitan Seattle
µg/L	micrograms per liter
MG	million gallons
MGD	million gallons per day
ml	milliliter
MLK	Martin Luther King
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PCMP	Post-Construction Monitoring Plan
PS	pump station
RS	regulator station
RWSP	Regional Wastewater Services Plan
SBS	sodium bisulfite
SCADA	supervisory control and data acquisition
Ship Canal	Lake Washington Ship Canal
SPU	Seattle Public Utilities
SS	settleable solids
SSO	sanitary sewer overflow
SSOP	Sewer System Operations Plan
SCIP	Source Control Implementation Plan
SMS	Sediment Management Standards

South Plant	South Treatment Plant in Renton
TBM	Tunnel boring machine
TRC	total residual chlorine
TSS	total suspended solids
TEPS	Tunnel Effluent Pump Station
WAC	Washington Administrative Code
West Point	West Point Treatment Plant
WTD	Wastewater Treatment Division
WWTS	wet weather treatment station
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. This report is WTD's annual report for calendar year 2022 for the combined portion of the conveyance system. This report includes a description of progress made implementing WTDs' Combined Sewer Overflow (CSO) Control Program. Furthermore, this annual report fulfills requirements under the National Pollutant Discharge Elimination System (NPDES) permit for the County's West Point Treatment Plant (West Point) (WA0029181) in Seattle and requirements in Washington Administrative Code (WAC) 173-245-090. King County submits CSO annual reports to the Washington State Department of Ecology (Ecology).

The NPDES permit for West Point was renewed on December 19, 2014, and became effective on February 1, 2015. The application for renewal of the NPDES permit for West Point was submitted in January 2019. The current NPDES permit expired on January 31, 2020, and Ecology is in the process of completing renewal of the permit. The current permit has been administratively extended until renewal occurs.

On July 3, 2013, a consent decree (CD), Civil Action No. 2:13-cv-677, between the U.S. 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 agreement from 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 critical 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. WTD is working to ensure the County is able to meet the required milestones and actions of the CD.

This report documents King County's CSO Control Program and CD implementation activities and information for the 2022 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 West Point
- Information on any dry weather overflows (DWOs)
- Updates on implementation of the CD
- Sewer System Operations Plan (SSOP) implementation
- Implementation of the Joint Operations and System Optimization Plan (JOSOP) between WTD and Seattle Public Utilities (SPU)
- Coordination between WTD and SPU on CSO control programs and projects

- NPDES permit compliance for the King County wet weather treatment stations (WWTSs)
- Coordination with SPU on implementation of source control best management practices (BMPs) in King County CSO basins

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 34 constituent agencies in the greater Seattle metro area, including 18 cities, 15 local sewer utilities, and one tribal government. King County's wastewater service area includes more than 1.9 million residents of King, Pierce, and Snohomish counties.

The majority of WTD's service area has separate pipes to (a) convey wastewater to WTD's treatment systems and (b) convey stormwater to local receiving water bodies. However, much of the City of Seattle is served by a combined sewer system that conveys wastewater and stormwater runoff in the same pipes. Within Seattle, WTD's responsibility begins where the City of Seattle's pipes have collected sewage from areas of greater than 1,000 acres and conveyed the sewage to WTD's system. WTD conveys most of the flow from Seattle (including most of the combined sewage flows) to West Point in Discovery Park. A small amount of sewage from Seattle is treated at WTD's South Treatment Plant in Renton (South Plant).

When large storms occur and flows exceed the capacity of the County's combined 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 (Ship Canal), the Duwamish River, Elliott Bay, and Puget Sound (Figure 1). CSOs may also occur at Seattle's 82 CSO locations in their local sewer system. SPU is responsible for separately managing and reporting on those locations.

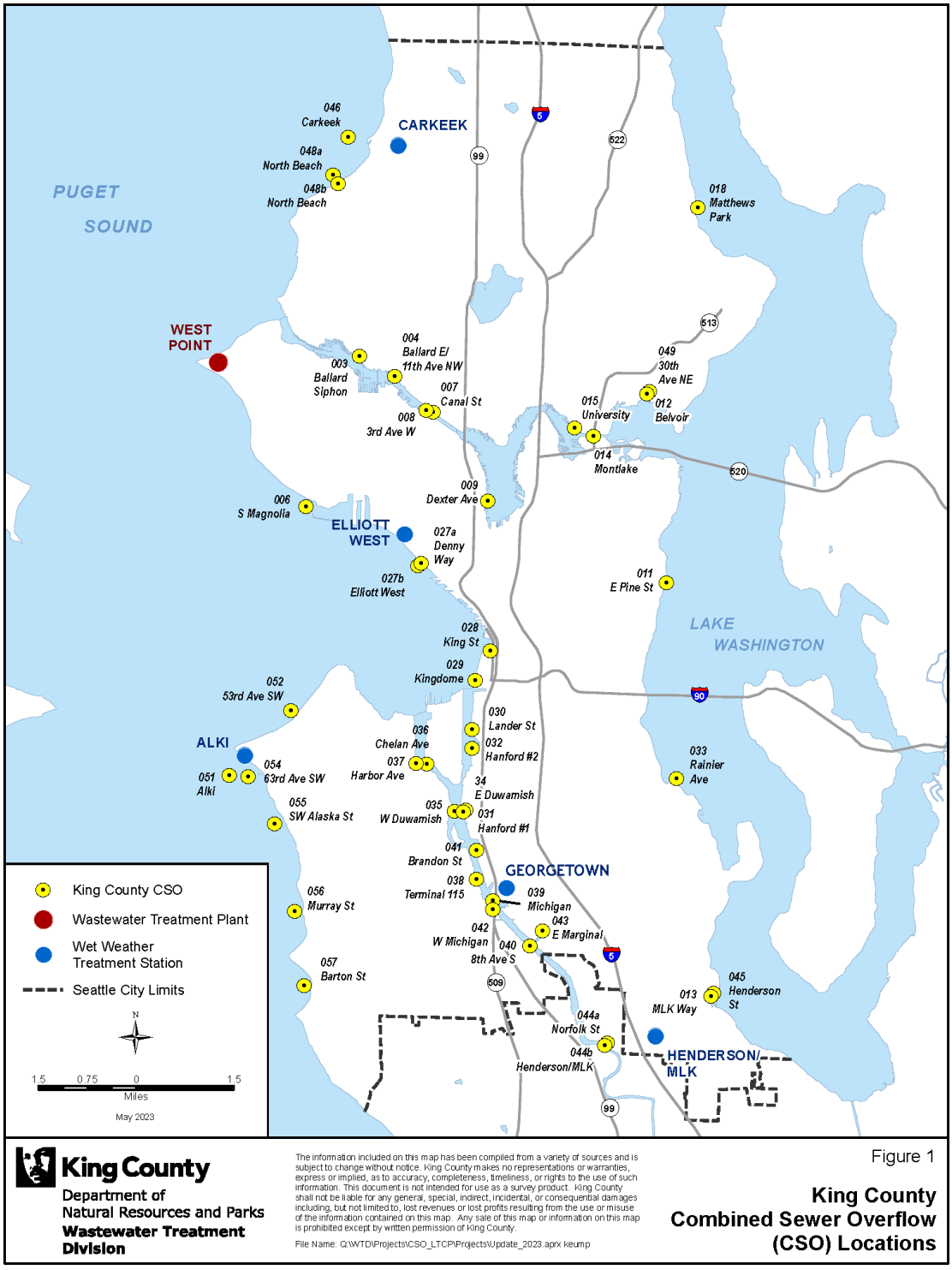

Figure 1. King County CSO Locations

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 West Point's NPDES permit. Before each CSO Control Plan update, the County reviews the plan and progress made toward CSO control and compares its existing program against conditions that may have changed since the last update (e.g., 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, 1968–2012

In 1968, the Forward Thrust Bond issue was approved, and extensive sewer separation was completed through 1977 in the Seattle area.

Metro first formalized CSO control with 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 Ship Canal). In 1985, the Washington State Water Pollution Control Act (Chapter 90.48 RCW [Revised Code of Washington]) 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 West Point, 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 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 (Elliott West WWTS)/Mercer Street Treatment Tunnel (Mercer St. 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; outlined how the County met 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 Street, Murray Avenue, South Magnolia, and North Beach, collectively 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 (LTCP) 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. The approved plan includes conducting green stormwater infrastructure (GSI) early, ahead of traditional CSO control projects, for four projects, to reduce the size of the gray infrastructure needed to control CSOs. The plan is consistent with the CSO CD, which governs the completion of these projects.

1.2.2 2018 CSO Control Planning

In January 2019, King County submitted its 2018 CSO Program Update as part of West Point's NPDES permit renewal, consistent with WAC 173-245-090 and King County Code 28.86.080. Since that time, King County has continued CSO planning efforts to understand the impact of changing conditions that influence program implementation and success. (More information on the related proposal for CD modification is available in Section 1.3 of this report.) The next LTCP amendment deadline is expected to be included in West Point's next NPDES permit.

1.2.3 Clean Water Plan

In 2018, concurrent with LTCP implementation, King County WTD began working on a wastewater comprehensive plan, called the Clean Water Plan. The purpose of the Clean Water Plan effort, as defined in 2018, was to assess all the demands on WTD as the regional wastewater utility, including CSOs, and plan a future direction for the regional system that makes the right investments at the right time. An overall objective of the Clean Water Plan was to amend the RWSP.

At the end of 2021, King County decided to pause the Clean Water Plan process to fully consider external feedback received and to develop adjustments that respond to that feedback. In addition, the County also recognized that two major regulatory efforts underway, Ecology's Puget Sound Nutrient General Permit and negotiations with Ecology and EPA regarding CSOs, have significant financial and policy effects on the Clean Water Plan and that the associated uncertainty affects long-term planning.

The County continued the pause in the Clean Water Plan process through 2022, allowing for the possibility of more regulatory clarity, which will give the County the opportunity to be responsive, adjust the planning process, and restart planning.

1.3 Consent Decree

After the King County Council approved 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 a complaint under the Clean Water Act brought by EPA and Ecology, resulting in the CD between King County, EPA, and Ecology. The CD was formally filed in U.S. District Court on July 3, 2013.

The CD commits King County to implement various CSO control measures and compliance activities to achieve full compliance with the Clean Water Act, applicable state law and regulations, and terms and conditions of the West Point NPDES permit, and to meet the requirements of EPA's CSO control policy. The CD also commits King County to complete construction of all CSO control projects by December 31, 2030. Compliance activities described in the CD include:

- Implementation of CSO control projects in accordance with milestones established in the CD
- Development of a SSOP and JOSOP
- Establishment of conditions for developing supplemental compliance plans to implement remedial measures for CSO control projects
- Establishment of requirements for proposals to substitute, in part, GSI control measures for gray infrastructure control measures

Meeting the conditions set forth in the CD is a high priority for King County. To date, the County has met all conditions outlined in the CD with two exceptions, that is, for one milestone associated with the Chelan CSO control project and one milestone associated with the West Duwamish CSO control project. On October 28, 2019, King County submitted a formal request to EPA and Ecology to delay the interim CD milestones for the Chelan CSO control project (specifically, Completion of Bidding and Construction Completion milestones) to match the milestones in the CD for Hanford #2, Lander, King, and Kingdome (HLKK) Wet Weather Station (retitled as the "Mouth of Duwamish" project in 2022).

On June 9, 2021, King County submitted a force majeure claim to EPA and Ecology for the West Duwamish CSO control project. The County submitted the claim anticipating missed milestones due to unanticipated additional time for coordination of parties involved with the plan for cleanup of legacy contaminants and the associated process to complete the property purchase from the Port of Seattle. Additional supporting information was sent in 2022. The force majeure claim was rejected by EPA and Ecology in October 2022, and the matter is in dispute resolution through 2023.

In conjunction with the October 28, 2019, request to align the Chelan CSO control project with the Mouth of Duwamish project (HLKK) milestones, the County also requested to initiate negotiations to modify the CD to accommodate changed conditions from 2013 when the CD was filed. The changed conditions include climate change that has increased the size of CSO control projects necessary to achieve compliance, additional wastewater system asset management needs, rising costs and other regional financial factors, and additional regulatory compliance obligations. The County, EPA, and Ecology (in coordination with the City of Seattle) were engaged throughout 2022 in negotiations to modify the CD to address these changed conditions.

1.4 Sediment Sampling and Analysis

In 1999, King County prepared a sediment management plan to address contaminated sediment at County CSO locations. The plan was updated, and the resulting King County Sediment Management Plan (SMP) 2018 Update was sent to Ecology on November 2, 2018. The SMP update proposes a strategy for assessing and managing potential or determined sediment impacts related to the County's CSOs to meet permit obligations as well as provide information needed to plan for required or anticipated future cleanup actions. The SMP update also describes all King County CSO discharge locations, summarizes ongoing and previously performed sediment cleanup work,

summarizes the results of CSO discharge modeling, and provides the status of existing sediment quality. As part of the update process, a predictive sediment contamination model for CSO discharges was developed. Supplemental sediment sampling data at CSO outfall locations were collected in 2012 (10 locations), 2014 (six locations), 2015 (one location), and 2018 (one location). Sediment data were collected in 2022 at the MLK Regulator Station/Henderson Pump Station Overflow location. A sediment quality data report will be submitted to Ecology in 2023.

The NPDES permit (§S13.B, p. 41) requires post-construction monitoring once CSO control projects are completed. The County's approved Post-Construction Monitoring Plan (PCMP) requires characterization by sampling or modeling to calibrate and verify model performance. The post-construction monitoring results for several overflows per the approved quality assurance project plan have been provided to Ecology in 2018 and 2019. No post-construction monitoring was required in 2022.

In 2022, the County updated the PCMP's Appendix C ("Sampling and Analyses Plan") for characterizing sediment quality at CSO outfall locations (King County 2022). This plan is used to support both sediment quality investigations and post-construction monitoring at King County CSO outfall locations.

1.5 Organization of this Report

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

- Report on implementation of EPA's Nine Minimum Controls (Section 2)
- Table showing the 20-year average frequency of untreated CSO events (Table 3)
- Status of CSO control projects in design or construction (Section 4)
- Discussion of 2022 rainfall and untreated and treated CSO events (Section 5)
- Detailed individual event-based table for unpermitted overflows in 2022 (Table 6)
- Summary of CD violations in 2022 (Section 6)
- Description of post-construction monitoring (Section 7)
- Detailed individual event-based tables for untreated CSOs in 2022 (Appendix A)
- Detailed individual event-based tables for treated CSOs in 2022 (Appendix B)
- Annual reports for the four satellite wet weather treatment stations (WWTSs): 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 the NPDES permit. The crosswalks shown in Table 1 indicate where information meeting the requirements of each can be found in this report

Table 1. 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 CD compliance measures, including Currently Underway and Early Action CSO Control Measures, the implementation of all CSO Control Measures in Appendix B, PCMP, 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 CD.	(i) 4.1 Project Summaries 4.2.1 Sewer System Operations Plan 4.2.2 JOSOP 4.2.3 WTD Coordination with SPU on CSO Control Projects 7.0 Post-construction monitoring (ii) Included in sections above, 5.4, and Appendices C–F for WWTSs (iii) 2.1 Reducing CSOs through Operations and Maintenance Appendices C–F for WWTSs (iv) All of the above
VIII.43.b	A description of any noncompliance with the requirements of this CD 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.	2.1 Reducing CSOs through Operations and Maintenance 6.0 Summary of CD Violations Appendices C–F for WWTSs

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.	3.0 Control Status of CSO Locations 5.0 Summary of Rainfall and CSO Events Appendix A Untreated CSO Events Appendix B Treated CSO Events Appendices C–F for WWTSs
WAC 173-245-090(1)(b)	Explains the previous year's CSO reduction accomplishments.	4.1 Project Summaries
WAC 173-245-090(1)(c)	Lists the projects planned for the next year.	4.1 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	3.1 Twenty-Year Moving Average of Event Frequencies Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B

	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.	
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.	3.1 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 underway. King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are part of EPA's codified CSO Control Policy and included in the West Point NPDES permit. The following sections describe King County's programs and activities regarding each of the Nine Minimum Controls, with emphasis on activities undertaken in 2022.

2.1 Control 1 – Reducing CSOs through Operations and Maintenance

Implement proper operations 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.

West Point and South Plant staff manage proper facility operation 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 use of the SCADA system.

Under its 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. King County's 2018 Strategic Asset Management Plan Update set the priorities of the Asset Management Program and work plan, and WTD is now working on implementation of the plan's recommendations.

The Asset Management Program, implemented by West Point, South Plant, and Conveyance Inspection staff, ensures regular maintenance of CSO outfalls, regulator stations, and pump stations. Conveyance inspection staff inspect sewers on a specified schedule and perform corrective actions when deficiencies are found. In 2022, Conveyance Inspection staff inspected about 11,300 linear feet of sewers in the combined system. Maintenance schedules and records of visits are available for inspection upon request.

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 to reduce the magnitude, frequency, and duration of CSOs.

The West conveyance system is essentially a deep in-line tunnel system that conveys and stores a wide range of flows. Figure 2 shows the sizing of the largest in-line tunnels. Maximizing storage in the conveyance system works in concert with maximizing

conveyance to West Point 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 levels in the interceptors and trunks, with little operator intervention.

When levels reach pre-determined set points, programmable logic controllers 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 offline 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. To manage flows to and through West Point, operators at West Point's Main Control will remotely take control of certain facilities, primarily Interbay Pump Station (Interbay PS) to force storage in the Mercer St. Treatment Tunnel, and the West Seattle Pump Station to then force storage in the West Seattle Tunnel. The intent of this operations strategy is to avoid customer overflows and backups, avoid surges and oscillations in the plant, protect the biological system and avoid plant shutdown, 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, including 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.

Figure 2. King County Wastewater West System Pipeline Storage

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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.

The King County Industrial Waste Program (KCIW) issues permits and discharge authorizations that set pollutant limits and other conditions on industrial discharges to protect worker safety, local and regional sewer infrastructure, treatment plants, recycled products, and water quality. The program includes the following activities: permitting, inspecting, sampling, monitoring, enforcement actions, engineering reviews and approvals of pretreatment systems, and technical assistance to businesses on appropriate waste pretreatment and disposal techniques. KCIW has a cost recovery program to recoup program costs as well as an awards program for companies and other entities who demonstrate excellent compliance. For permit issuance, King County works with Ecology and local sewer agencies during the permit approval and renewal process to allow for review and comment. 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 previous calendar year, as well as an evaluation of influent, effluent, and biosolids focusing on loading and removal rates.

Influent and effluent quality at West Point is assessed for trends that would suggest concurrent changes in CSO discharges. In addition, biosolids quality data from West Point are tracked as an indicator of changed loading to the system that could influence CSO quality. No specific new trends were observed in 2022 in pollutant concentrations. Biosolids concentrations are relatively stable and well below EPA's standards. Beginning in 2016, WTD began to include the downstream CSOs to which each permitted industrial discharger contributes in its annual pretreatment report submitted to Ecology.

King County also administers and helps fund the Hazardous Waste Management Program (HWMP). The Business Services Team of HWMP provides site visits to businesses that generate hazardous wastes (and that typically fall below the threshold for receiving a discharge authorization or permit from the Industrial Waste Program). Their efforts focus on on-site technical assistance visits to businesses for hazardous material and waste management, including discharges to sanitary and storm drains, and identifying safer chemical substitutions. HWMP issues vouchers to reimburse businesses 75 percent of their costs (up to $599) for purchasing and installing pollution prevention equipment, if needed. They also provide spill kits and spill management plans to the businesses they visit.

King County is currently implementing the second five-year Source Control Implementation Plan (SCIP) for the Lower Duwamish Waterway, which covers activities from 2019 to 2023. Per the SCIP, King County submits Source Control Annual Reports documenting source control activities for that period. The Source Control Annual Report documenting 2021 activities was submitted to Ecology in October 2022. The Source

Control Annual Report for 2022 activities will be submitted in 2023. In addition, the County will be developing the third five-year SCIP in 2023 for the period of 2024 to 2028.

KCIW and the Sediment Management Program (as well as King County Stormwater Services and the King County International Airport) participate in the Lower Duwamish Waterway Source Control Work Group, which was formed to promote discussions of source control issues that may affect sediment remediation of the Lower Duwamish Waterway. The group's participants include King County, City of Seattle, Port of Seattle, the City of Tukwila, Washington State Department of Transportation, and the two agencies with regulatory responsibility for different aspects of Lower Duwamish Waterway sediment remediation (i.e., Ecology and EPA). Ecology is the lead agency for this group, which has been meeting regularly for several years.

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 conveyance system is essentially a deep in-line tunnel system that can convey a wide range of flows to West Point. SCADA is used to maximize flow to the secondary treatment 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) of flow to West Point. West Point provides secondary treatment for all base flows (defined by Ecology as 2.25 times the average wet weather flow) up to 300 MGD and primary treatment for all 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 (i.e., 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 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 because of conveyance system limitations, flows are conveyed to WWTSs where they receive primary treatment and disinfection before being discharged. King County currently operates five WWTSs: Alki WWTS, Carkeek WWTS, Elliott West WWTS,

Henderson/MLK Jr. Way WWTS, and Georgetown WWTS. The Georgetown WWTS came online at the end of 2022.

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 dry weather 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. King County takes each of these overflows seriously, and they are immediately corrected and reported to Ecology (see Section 5.2).

To minimize the risk of a DWO due to power loss at a pump station, generators and automatic power transfer systems were installed at pump stations throughout the system, greatly reducing the risk of overflows associated with a loss of power. To minimize the risk of mechanical failure, the King County Asset Management Program maintains a Strategic Asset Management Plan that is updated on a five-year cycle. The plan, which was updated in 2018, includes an assessment to determine the criticality of pump station equipment. This assessment identifies assets essential to pumping sewage; inspection and maintenance routines have been developed to increase service time and reduce failures for these assets. Assessments and evaluations are continuously updated to reduce the likelihood of system failure. These efforts will contribute to reducing overflows by decreasing the probability of mechanical failures.

Operations and maintenance (O&M) programs, as described for Control 1 (Section 2.1), focus on eliminating 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).

2.7 Control 7 – Preventing Pollution

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

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 ongoing efforts in 2022 to coordinate with SPU programs to ensure pollution prevention programs align, cover the geographic area fully, and are comprehensive in addressing all pollution types (i.e., solid waste, wastewater, stormwater, etc.). This section is divided into subsections that describe existing industrial and commercial programs, community programs, and stormwater programs.

Programs to Support Pollution Prevention with Industrial and Commercial Discharges

KCIW, along with the County's HWMP, implements activities to provide source control within the combined sewer system. Industrial facilities throughout Seattle that are permitted by KCIW are required to limit the discharge of chemicals and other substances to sanitary sewers 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.

KCIW established local discharge limits in public rule for various pollutants of concern, including the discharge of fats, oils, 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. They also 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. Polar FOG has a screening level, but limits can be established on a case-by-case basis.

King County also prohibits discharge to the sanitary 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.

King County is currently implementing the second five-year SCIP for the Lower Duwamish Waterway, which covers activities from 2019 to 2023. The Plan includes working with Lower Duwamish businesses on pollution prevention as well as County-performed source tracing activities and compliance with water quality permits and regulations at County-owned and -operated facilities. The activities conducted under the Plan are summarized in a series of source control annual reports that are submitted to Ecology. The 2021 activities report was prepared in 2022 and submitted to Ecology in October 2022. The 2022 source control activities associated with this second five-year Plan will be summarized in a report developed in 2023. In addition, the County will be developing the third five-year SCIP for the period of 2024 to 2028 in 2023.

The HWMP is a multi-jurisdictional effort by King County, SPU, two tribal governments, and 37 local towns and cities that is implemented through a Management Coordination Committee and enabled by the King County Board of Health. The HWMP 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 HWMP creates plans to manage hazardous wastes produced by households and in small quantities by businesses and other organizations. The HWMP is funded by local hazardous waste fees on solid waste (garbage) and sewer accounts.

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 (e.g., water conservation programs, Adopt-a-Road, Adopt-a-Street, recycling

resources). Both KCIW and HWMP maintain extensive online program information and availability of resources and events. The County's HWMP manages free hazardous waste collection services for household and business wastes (e.g., mobile collection, hazardous waste collection/drop-off sites). The King County Board of Health passed the Secure Medicine Return Regulation in 2013 (also known as the "Drug Take Back" Program) that generates tax revenues from pharmaceutical sales for the HWMP 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).

In partnership with SPU, WTD has administered the RainWise Program since 2013. 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 as well as sources of pollution into the combined system. As of December 31, 2021, WTD has rebated 1,018 projects in King County CSO basins. These projects capture runoff from over 1.26 million square feet of roof area on private property, controlling an estimated 12.58 million gallons (MG) of stormwater per year.

WTD funds and administers the WaterWorks Grant Program to help nonprofit organizations, local agencies, educational institutions, and community groups implement small-scale projects to improve 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 local waterways. The projects 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 projects are all within the sewer service area and help King County residents protect their long-term investment in water quality.

Since the WaterWorks Grant Program started in 2015, the total number of projects funded is 244 and total funding is $17.3 million. The grant cycle is biennial, so no new projects were awarded funding in 2022; the next grant cycle begins in 2023. The 68 new projects awarded funding in 2021 are being implemented in the 2022 to 2025 timeframe and are expected to protect water quality, control pollution, and build healthy communities. The projects include a variety of approaches, such as restoring stream and riverbanks, installing rain gardens, educating students and teachers, training youth in water quality job skills, monitoring water quality, and research. Nineteen previously funded projects were also completed in 2022.

To meet NPDES permit obligations, King County relies on SPU to implement pollution prevention actions (e.g., spill response, water quality complaint response, and street sweeping) in areas of the city served by County CSO facilities. SPU provides pollution prevention actions in County CSO basins, as follows, but is not responsible for the County's NPDES permit compliance:

- Water Quality Complaints: SPU inspectors respond to complaints as they are received through the water quality hotline, webpage, or agency referrals. This program provides outreach and education on proper BMPs to residents and businesses within the City of Seattle.
- Spill Response: SPU's on-call spill response coordinators are dispatched through the SPU Operations Response Center to assist with spill investigation and cleanup activities as they are received.
- Street Sweeping: SPU coordinates with the Seattle Department of Transportation to conduct street sweeping on arterials in Seattle using high-efficiency regenerative air street sweepers.

Implementation of Source Control Actions in CSO Basins

WTD and SPU staff coordinate the mutual tracking and sharing of information on stormwater pollution prevention BMPs that are implemented within combined basins consistent with the provisions of each agency's NPDES permit. Because all of King County's CSOs serve areas within the City of Seattle's boundaries, the City's management and maintenance activities under their Stormwater Code and Side Sewer Code 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, spill response, water quality complaint investigations, stormwater system maintenance, and catch basin cleaning. At WTD-owned facilities within Seattle, O&M staff also perform spill response, drainage facility maintenance, and catch basin cleaning. Both King County and SPU maintain hotlines for the reporting of illegal dumping. The County routes reports to the appropriate jurisdictional entity for cleanup of sites.

Seattle Municipal Code, Chapters 22.800 through 22.808, contains the City of Seattle's Stormwater Code, which is the City's primary means of implementing the following requirements: (1) to practice stormwater pollution prevention during construction; (2) to reduce the introduction of pollutants into stormwater runoff as close to the source as possible; and (3) to install flow control, stormwater treatment facilities, or both depending on the size and nature of a project. The Stormwater Code is implemented through the "Directors' Rule," promulgated jointly by the director of SPU and the director of the Seattle Department of Construction and Inspections. The Code and Manual establish SPU's authority to implement mandatory citywide BMP requirements 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 annually 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: The City of Seattle requires all real property to implement proper liquid waste storage, disposal, and runoff prevention measures.
- Proper Storage of Solid Wastes: The City of 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.
- Rooftop Dog Runs: Rooftop dog runs must be sized to minimize the volume of stormwater discharged to the sanitary sewer or combined sewer systems.

Ecology has determined that the City of Seattle's Stormwater Code and Manual are equivalent to Ecology's Surface Water Design Manual for Western Washington. This equivalency establishes the city's legal authority to control discharges to and from municipal stormwater systems. SPU has a citywide pollution prevention program and performs actions such as spill response and catch basin inspection and cleaning. These actions are conducted in WTD CSO basins in the spirit of coordination. Finally, both WTD and SPU conduct stormwater drainage and mapping programs to document the boundaries of separated, partially separated, and combined basins.

In reviewing the pollution prevention programs in combined basins described above, both WTD and SPU have determined that existing legal authorities are sufficient to effectively administer and implement these programs. Accordingly, WTD and SPU will implement the pollution prevention program that is consistent with each agency's NPDES permits and provide benefits to each agency's combined sewer system.

King County coordinates with SPU to implement pollution prevention actions (e.g., spill response, water quality complaint response, and street sweeping) in areas of the city served by County CSO facilities. SPU provides pollution prevention actions in County

CSO basins, as follows, but is not responsible for the County's NPDES permit compliance:

- Water Quality Complaints: SPU inspectors respond to complaints as they are received through the water quality hotline, webpage, or agency referrals. This program provides outreach and education on proper BMPs to residents and businesses within the City of Seattle.
- Spill Response: SPU's on-call spill response coordinators are dispatched through the SPU Operations Response Center to assist with spill investigation and cleanup activities as they are received.
- Street Sweeping: SPU coordinates with the Seattle Department of Transportation to conduct street sweeping on arterials in Seattle using high-efficiency regenerative air street sweepers.

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, and other public outreach activities. In 2017, SPU and the King County Department of Natural Resources and Parks (DNRP) developed a new CSO outfall sign design with more languages, a link to the CSO overflow website, and a new phone number that is staffed 24 hours a day. DNRP fabricated and installed the new signs in 2019. Installation of the signs at SPU's CSO outfalls was partially completed in 2021 and 2022 due to O&M staffing reductions resulting from the COVID-19 pandemic. SPU is planning to complete installation of the signs at their remaining CSO outfalls in 2023.

King County maintains a mobile-friendly website that provides real-time notification of recent and current CSO discharges within the City of Seattle (http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx). The website presents a map with overflow status for the majority of Seattle and County CSOs, with links to and from each agency's independent websites. This information helps people make decisions about using local waters for recreational activities. King County responds to inquiries from the public who have questions about using the map and the data it presents.

In 2022, the "CSO status" webpages had 8,839 page views (representing 7,500 unique page views, with 83 percent of users viewing and then leaving the page [bounce rate]).

This represented a 33 percent increase in page views from 2021, during which there were 6,668 page views.

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, evaluating the efficacy of the technology-based controls, and determining the baseline conditions for the LTCP. These data must include:

- 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.
- Total number of CSO events and the frequency and duration of CSOs for a representative number of events.
- Locations and designated uses of receiving water bodies.
- Water quality data for receiving water bodies.
- Water quality impacts directly related to CSOs (e.g., 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 West Point effective July 1, 2009, King County developed a comprehensive sediment quality summary report for all CSO discharge locations (submitted December 2009 and supplemented in 2018).

A summary of the report includes discussion of receiving water characteristics based on sampling results from the County's long-term marine ambient and point source monitoring program. Overall, the study showed that ambient water in the Duwamish area met the Washington State water quality standards for aquatic life or EPA's recommended human health criteria for metals.

The report can be found at:
http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/SedQuality/0912_CompSedQualSumRptCSODischargeLoc.pdf.
https://www.kingcounty.gov/~/media/services/environment/wastewater/cso/docs/sed-qual/2018-Comprehensive-Sediment-Quality-Summary-Report.ashx?la=en.

Using all sediment data collected over the years, the County tracks sediment quality status at all CSO locations. One location that was identified as needing further investigation had sediment data collected in 2022 (at the MLK Regulator Station/Henderson Pump Station Overflow location). A sediment quality data report will be submitted to Ecology in 2023.

King County's 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. (See also Section 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.

The County provided the post-construction monitoring results for several overflows per the approved quality assurance project plan to Ecology in 2018 and 2019. No post-construction monitoring was required in 2022.

3 Control Status of CSO Locations

3.1 Twenty-Year Moving Average of Event Frequencies

The Washington State CSO performance standard is defined in WAC 173-245-020(22) as “control of each CSO in such a way that an average of one untreated discharge may occur per year.” According to the West Point NPDES permit, effective July 1, 2009, Ecology evaluates compliance with the CSO performance standard annually based on a 20-year moving average. The CD also recognizes this performance standard. The number of untreated discharges that occurred over each of the previous 20 years is reported for each outfall in Table 3 along with the 20-year moving average. This moving average is used each year to assess compliance with the CSO 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 lack the 20 years of post-construction measured data, the table substitutes modeled data of the new facilities’ simulated performance with the historic rainfall over those years for the unavailable measured data.

The following 18 CSO outfalls, with the corresponding discharge serial number (DSN), were identified as controlled through the monitoring and modeling data:

1. 53rd Avenue Southwest Pump Station Overflow, 052 (53rd Ave. SW PS)
2. 8th Avenue South Overflow, 040 (8th Ave. S)
3. Ballard Siphon Overflow, 003
4. Canal Street Overflow, 007 (Canal St.)
5. Dexter Ave. Regulator Station Overflow, 009 (Dexter Ave. RS)
6. East Duwamish Pump Station Overflow, 034 (E Duwamish PS)
7. East Marginal Way Pump Station Overflow, 043 (E Marginal Way PS)
8. East Pine Street Pump Station Overflow, 011 (E Pine St. PS)
9. Harbor Avenue Regulator Station Overflow, 037 (Harbor Ave. RS)
10. Henderson Street Pump Station Overflow, 045 (Henderson St. PS)
11. Martin Luther King Junior Way Overflow, 013 (MLK Jr. Way)
12. Matthews Park Pump Station Overflow, 018 (Matthews Park PS)
13. Murray Avenue Pump Station Overflow, 056 (Murray PS)
14. Norfolk Street Overflow, 044a (Norfolk St.)
15. North Beach Pump Station Inlet Overflow, 048b (North Beach PS Inlet)
16. Rainier Avenue Pump Station Overflow, 033 (Rainier Ave. PS)
17. Southwest Alaska Street Overflow, 055 (SW Alaska St.)
18. West Duwamish Overflow, 035 (W Duwamish)

The following 13 CSO outfalls, with the corresponding DSN, were identified as uncontrolled through the monitoring and modeling data:

1. 11th Avenue Northwest Overflow, 004 (11th Ave. NW)
2. 30th Avenue Northeast Overflow, 049 (30 Ave. NE)
3. 3rd Avenue West Overflow, 008 (3rd Ave. W)
4. Chelan Avenue Regulator Station Overflow, 036 (Chelan Ave. RS)
5. Hanford #2 Regulator Station Overflow, 032 (Hanford #2 RS)
6. King Street Regulator Station Overflow, 028 (King St. RS)
7. Kingdome Regulator Station Overflow, 029 (Kingdome RS)
8. Lander Street Regulator Station Overflow, 030 (Lander St. RS)
9. Montlake Regulator Station Overflow, 014 (Montlake RS)
10. North Beach Pump Station Wet Well Overflow, 048a (North Beach PS Wet Well)
11. Terminal 115 Overflow, 038
12. University Regulator Station Overflow, 015 (University RS)
13. West Michigan Street Regulator Station Overflow, 042 (W Michigan St. RS)

This is the first year that the 20-year moving average for 30th Avenue Northeast Overflow and North Beach Pump Station Wet Well Overflow have exceeded one event/year after previously being controlled. Per the Draft West Point NPDES permit, the County is assessing the data and will continue monitoring these outfalls. The County is beginning its evaluation of these outfalls and if the 20-year moving averages exceed one event/year for two consecutive years, the County will take corrective action.

The following four CSOs, with the corresponding DSN, were identified as needing further monitoring to determine their control status:

1. Denny Way Regulator Station Overflow, 027a (Denny Way RS)
2. Barton Street Pump Station Overflow, 057 (Barton St. PS)
3. South Magnolia Overflow, 006 (S Magnolia)
4. Hanford #1 Overflow, 031a (Hanford #1)

The following outfalls, with the corresponding DSN, were in control when the CD was signed, but were identified as needing supplemental compliance activities and further monitoring. A letter was submitted to Ecology in December 2017 acknowledging that Belvoir PS Overflow fell out of control in 2016. Another letter was submitted to Ecology in May 2018 acknowledging that 63rd Ave. SW PS Overflow fell out of control in 2017.

1. 63rd Avenue Southwest Overflow, 054 (63rd Ave. SW)
2. Belvoir Pump Station Overflow, 012 (Belvoir PS)

The following two outfalls, with the corresponding DSN, were identified as needing post-construction monitoring to determine their control status after CSO project construction completion:

1. Brandon Street Regulator Station Overflow, 041 (Brandon St. RS)

2. South Michigan Street Regulator Station Overflow, 039 (S Michigan St. RS)

Table 2 and Figure 3 further demonstrate the control status of all King County CSOs. The table and figure are broken down by control status category and differentiate uncontrolled CSOs that have projects currently underway, CSOs that have drifted out of control due to operational changes and climate change, and future projects that are planned.

3.2 Belvoir and 63rd

In a letter submitted to Ecology in December 2017, WTD outlined the control status for the Belvoir PS Overflow. Belvoir PS Overflow, which is within King County's CSO system, has historically been reported as controlled. However, updated modeling indicated that the CSO frequency has increased due to hydraulic and hydrologic changes upstream of the pump station. As of the 2016 Annual CSO and CD Report, Belvoir PS Overflow (No. 012) does not meet the CSO control performance standard.

WTD and SPU recognize that hydraulic and hydrologic changes have affected compliance at the Belvoir PS Overflow. WTD is committed to coordinating and developing mutually beneficial solutions with SPU. This includes working with SPU to meet the approach and schedule included in SPU's approved Windermere Basins 13 and 15 Supplemental Compliance Plans, dated December 7, 2016, and April 18, 2018, respectively. In addition, SPU and King County are working together to develop strategies for controlling Belvoir as part of WTD's LTCP planning. SPU is a member of WTD's LTCP planning team. The goal is to develop a preferred strategy and implementation schedule as part of WTD's next LTCP Update. WTD is working closely with SPU to bring this outfall into compliance by the end of the consent decree.

In a letter submitted to Ecology in May 2018, WTD outlined the control status of the 63rd Ave. SW PS Outfall. The 63rd Ave. SW PS Outfall, which is within King County's CSO system, has historically been reported as controlled. However, in 2017, monitoring data indicated that the CSO frequency increased because of hydraulic changes. As of 2017, the 63rd Ave. SW PS Outfall (No. 054) does not meet the CSO control performance standard.

Actions to improve compliance include optimization of the West Seattle portion of the CSO system, which includes operating the Alki WWTS more frequently. Recent improvements have also been made to the 63rd Ave. SW PS, including changing two constant speed pumps to variable speed pumps as well as electrical and control upgrades. These upgrades will increase operating flexibility and improve performance of the 63rd Ave. SW PS and the Alki WWTS. A comprehensive computer model of the West Seattle System was completed in 2018, and it is being used to optimize operations. A flap gate was also installed on the 63rd Ave. SW PS outfall to prevent saltwater intrusion. The majority of the flap gate installation work was completed in

2018, and the final outstanding item was completed in 2020. Operations staff will continue to monitor and determine if further operational adjustments are needed to control this outfall.

Table 2. Outfall Control Status by Category

Outfall Status	Number of Outfalls
Controlled	18
Uncontrolled – project underway	9
Uncontrolled – under supplemental compliance[a]	4
Uncontrolled – previously controlled[b]	4
Uncontrolled – future project	2
Project Complete – post-construction monitoring	2

[a] Supplemental Compliance Projects are a requirement of the CD and are only applicable to the projects contained within.
[b] These projects were considered controlled at the time the CD was signed and have since trended out of control.

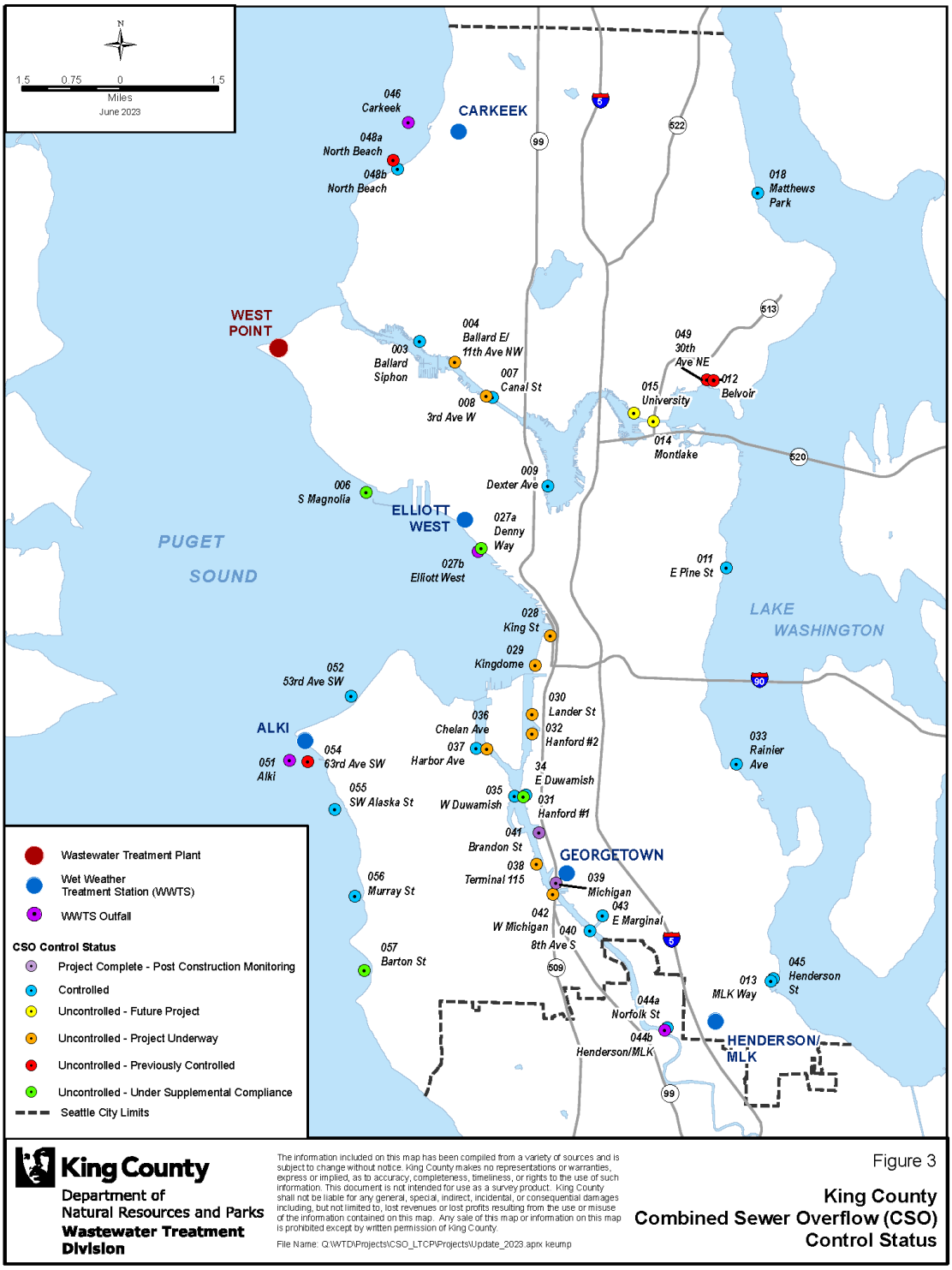

Figure 3. King County CSO Outfall Control Status

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Table 3. King County Untreated CSO Events, Averages and Baselines, 2003–2022[8]

Overflow Name	(DSN)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	20-Year Average[1]	1983 Baseline (24 hr. inter-event)
Ballard Siphon	003	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	2	0	0	0	0	0	1	0	0	**0.3**	13
11th Ave. NW[2]	004	8	6	11	22	10	7	16	19	16	20	12	25	17	22	21	13	10	18	20	9	**15.1**	16
S Magnolia	006	*2*	*1*	*0*	*0*	*1*	*0*	*1*	*2*	*2*	*1*	*3*	*1*	*4*	*1*	*0*	*0*	2	3	2	3	**1.5**	25
Canal St.	007	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	1	1	1	0	**0.5**	1
3rd Ave. W[3]	008	6	4	5	13	6	3	9	8	7	13	5	12	7	5	6	7	2	9	6	10	**7.2**	17
Dexter Ave. RS	009	*0*	*1*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*3*	0	0	0	0	1	0	0	**0.4**	15
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
Belvoir PS	012	2	2	0	1	1	0	0	2	0	1	1	1	5	2	2	1	1	1	2	5	**1.5**	1
MLK Jr. Way[4]	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	11	5	6	NM	0	1	3	10	8	18	7	22	15	16	12	7	6	11	9	13	**9.5**	6
University RS	015	4	4	3	12	5	3	9	8	6	13	4	14	11	9	7	7	2	7	4	9	**7.1**	13
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
Denny Way RS	027a	*1*	*1*	*0*	*2*	*2*	*0*	*1*	*2*	*1*	*1*	*1*	*2*	*4*	*2*	*1*	*0*	0	1	1	2	**1.3**	32
King St. RS	028	16	15	20	27	7	3	15	18	15	13	2	22	19	14	3	4	3	6	7	6	**11.8**	16
Kingdome RS	029	0	2	5	4	5	1	8	6	2	11	6	22	17	12	16	15	5	16	7	8	**8.4**	29

Control Status of CSO Locations

Lander St. RS	030	12	9	8	28	8	6	19	17	15	25	8	29	17	25	21	19	9	28	23	20	**17.3**	26
Hanford #1[2]	031	*2*	*0*	*0*	*4*	*1*	*0*	*3*	*2*	*2*	*2*	*3*	*3*	*3*	*2*	*3*	*1*	2	7	4	5	**2.5**	30
Hanford #2 RS	032	12	16	15	26	12	8	17	17	15	23	9	26	16	24	18	17	9	28	23	18	**17.5**	28
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
E Duwamish PS[2]	034	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	**0.3**	1
W Duwamish[2, 5]	035	NM	NM	1	0	1	0	0	1	0	0	1	0	1	0	1	0	1	1	1	2	**0.6**	1
Chelan Ave. RS	036	3	1	2	5	2	0	0	3	4	13	4	12	13	9	10	8	2	5	4	10	**5.5**	7
Harbor Ave. RS	037	*2*	*0*	*1*	*1*	*2*	*0*	*1*	*2*	*1*	*1*	*0*	*1*	*3*	*1*	*2*	*0*	1	1	0	0	**1.0**	30
Terminal 115[2, 6]	038	2	0	2	7	4	0	3	3	0	1	1	0	1	1	2	1	1	1	1	2	**1.7**	4
S Michigan St. RS	039	9	6	5	13	5	3	10	12	14	16	8	26	17	16	13	17	6	14	13	8	**11.6**	5
8th Ave. S	040	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	2	5	**0.6**	6
Brandon St. RS[7]	041	28	21	27	11	NM	3	16	11	7	12	7	16	14	12	6	3	2	6	0	2	**10.7**	36
W Michigan St.	042	4	1	3	8	4	0	8	9	3	5	2	3	6	9	6	4	1	3	4	6	**4.5**	34
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
Norfolk St[4].	044a	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	**0.1**	20
Henderson St. PS[4]	045	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	12
North Beach PS Wet Well	048a	*2*	*0*	*0*	*0*	*1*	*0*	*0*	*1*	*2*	*1*	*1*	*1*	*2*	1	3	2	1	1	2	4	**1.3**	18
North Beach PS Inlet[2]	048b	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	1	1	1	1	1	3	**0.3**	18
30th Ave. NE[2]	049	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0	2	3	1	0	1	0	1	2	2	**1.2**	1

Control Status of CSO Locations

53rd Ave. SW PS	052	0	0	0	2	1	1	0	0	0	1	0	0	1	0	1	0	0	2	2	1	**0.6**	<1
63rd Ave. SW	054	2	0	1	0	0	0	0	1	1	3	2	2	4	5	5	1	1	2	2	3	**1.8**	2
SW Alaska St.[2]	055	0	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	1	1	0	0	**0.4**	1
Murray Ave. PS	056	*2*	*0*	*0*	*2*	*1*	*1*	*1*	*1*	*0*	*1*	*2*	*1*	*2*	*0*	1	1	1	1	0	0	**0.9**	5
Barton St. PS	057	*0*	*0*	*2*	*1*	*3*	*2*	*2*	*0*	*0*	*1*	*3*	*1*	*2*	*0*	*0*	*1*	2	2	1	2	**1.3**	9

Notes: Modeled numbers are shown in *italics* with an underline and a blue background. NM = not monitored.
[1] 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.
[2] Portable monitors are used at 11th Ave. NW, 30th Ave NE, SW Alaska St., E Duwamish, W Duwamish, Hanford #1, S Magnolia, North Beach PS Inlet, and Terminal 115. The Hanford #1 (Bayview North) monitor was installed in 2010; the Hanford #1 (Bayview South) monitor was installed in 2011.
[3] The 3rd Ave. W monitor was down June 2006 through November 2006.
[4] 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 historic rain patterns during that time
[5] Monitoring began at W Duwamish in June 2005.
[6] Monitoring began in June 2003 at Terminal 115.
[7] 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
[8] A quality control check was performed on Table 3, Untreated CSO Events, Averages and Baselines, 2003-2022, to identify and correct previous counting errors.

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4 CSO Control Measures Currently Underway

This section describes the progress made implementing current CSO control projects and other projects that affect CSO control. It includes project-specific summaries of progress made in 2022, planned activities for 2023, and the status of each project relative to the schedule of CD milestones.

The CD requires the County to report on projects underway and the status of early action CSO control measures. Table 4 summarizes the CD milestone statuses through 2022. Figure 3 shows the locations of the CSOs and the status of the related project(s).

Table 4. Summary of King County Consent Decree Milestones through 2022

CSO Name (Project Name)	DSN	Current CD Commitment	Current Status
Barton St. PS (Barton St. Roadside Raingardens and Barton St. PS Upgrades)	057	Updated Supplemental Compliance Plan submitted to Ecology August 30, 2022. Progress reported annually. Control status to be determined in 2025, 2026, and 2027 Annual Reports.	Corrective actions being performed per Supplemental Compliance Plan
Ballard Siphon Regulator (Ballard Siphon Project)	003	CSO outfall controlled by December 31, 2014	Outfall controlled December 2014
Chelan Ave. RS (Chelan Ave. CSO Project)[i]	036	Completion of bidding by December 31, 2020	Request to modify milestones submitted to regulators 10/25/2019 and reiterated in a 3/25/2021 letter
Brandon St. RS/S. Michigan St. Regulator Station (Georgetown Wet Weather Treatment Station)[i]	039, 041	Construction completion by December 31, 2022	Construction completion milestone achieved
Hanford #2 RS/Lander St. RS/King St. RS/Kingdome RS (Mouth of Duwamish)[i]	032 030 028 029	Submit Facility Plan by December 31, 2024	Project planning underway. Request to modify CD submitted on October 28, 2019. Request included combining Chelan milestones with HLKK and extending completion beyond 2030

CSO Name (Project Name)	DSN	Current CD Commitment	Current Status
Montlake RS (Project Name TBD)[i]	014	Submit Facility Plan by December 31, 2023	Uncontrolled – future project. Request to modify CD submitted on October 28, 2019. Request included extending completion beyond 2030.
Murray Ave. Pump Station (Murray Wet Weather Storage Project)	056	CSO controlled by December 31, 2017	Outfall controlled December 2017
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)[i]	031	Did not meet control performance standard; Supplemental Compliance Plan submitted August 28, 2020; progress reported annually; control status to be determined in July 2024	Corrective actions being performed per Supplemental Compliance Plan
11th Ave. NW/3rd Ave W (Ship Canal Water Quality Project)[ii]	004, 008	(For King County) construction completion by December 31, 2025	Project construction underway
South Magnolia (South Magnolia Wet Weather Storage Project)	006	Updated Supplemental Compliance Plan submitted to Ecology August 30, 2022. Progress reported annually. Control status to be determined in 2025, 2026, and 2027 Annual Reports.	Corrective actions being performed per Supplemental Compliance Plan.
University RS (Project Name TBD)[i]	015	Submit Facility Plan by December 31, 2023	Uncontrolled – future project. Request to modify CD submitted on October 28, 2019. Request included extending completion beyond 2030.

CSO Name (Project Name)	DSN	Current CD Commitment	Current Status
West Michigan St. Regulator/Terminal 115 (West Duwamish CSO Control Project)[i]	038, 042	Completion of bidding by December 31, 2022	Project design underway. Site in Ecology cleanup order, with anticipated delay to milestones notified in force majeure submittals in 2021. Force majeure is in dispute resolution through 2023.
Dexter Ave. RS (Dexter Ave. Supplemental Compliance Plan)	009	Supplemental Compliance Plan submitted August 2013; control status to be reported in 2016 Annual Report	Outfall controlled July 2016
Denny Way RS (Denny Way Supplemental Compliance Plan)	027a	Updated Supplemental Compliance Plan submitted to Ecology August 30, 2022. Progress reported annually. Control status to be determined in 2034 Annual Report after completion of the Mouth of Duwamish CSO Control project.	Corrective actions being performed per Supplemental Compliance Plan
Harbor Ave. RS (Harbor Ave. Supplemental Compliance Plan)	037	Updated Supplemental Compliance Plan submitted to Ecology August 30, 2022. Control status to be determined in 2023, 2024, and 2025 Annual Reports.	Monitoring for achievement of performance standard. Based on 2003–2022 data, outfall is controlled.

[i] Capital project set forth in Appendix B of the CD.

[ii] Per October 25, 2016, Non-Material CD Modification. CD Appendix A refers to two stand-alone CSO outfalls, East Ballard (aka 11th Ave. NW) and 3rd Ave. W and Ewing St. (aka 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 interim CD milestones will be used to measure progress, but are not part of the King County CD modification because SPU is the project lead, and their dates are earlier than the County's CD dates for a collaborative project in the non-material CD modification.

Project Summaries

A summary project status page for 2022 for each active project follows. These project summaries do not include past completed projects or upcoming projects.

Projects in progress include:

- Georgetown Wet Weather Treatment Station
- Ship Canal Water Quality Project
- West Duwamish
- University GSI
- Chelan Ave. CSO Project
- HLKK CSO Project

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 WWTS, associated conveyance, and marine outfall. For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/georgetown.aspx.

Milestones	CD Milestone Date (Actual Date)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Submission of Facilities Plan	12/31/2015 (Draft submitted 11/2/2015)												
Completion of Bidding	12/31/2017 (11/30/2017)												
Construction Completion	12/31/2022 (11/22/2022)												
Achievement of Performance Standard	4/30/2025 (N/A)												

2022 Accomplishments:

- Achieved Final Acceptance of the conveyance pipeline.
- Met construction completion CD milestone on 11/22/22; issued Substantial Completion on the Treatment Station construction contract.
- Began startup and commissioning of the Treatment Station.

2022 Challenges and Corrections:

- Treatment station construction contract – Various changes to the contract were executed in 2022 to account for design changes/clarifications, differing site conditions, and impacts resulting from the COVID-19 pandemic.

2023 Activities in Progress or Expected:

- Complete commissioning of the facility with contractor
- Continue verifying performance compliance for CD

CD/CSO Report Project Status

Ship Canal Water Quality Project

CSO(s): DSN 008 (3rd Ave. W Outfall) and DSN 004 (11th Ave. NW Outfall)

Project Description: The Ship Canal Water Quality Project (Ship Canal Project) is a joint SPU–WTD project that will control CSOs from SPU's Wallingford, Fremont, and Ballard areas (Outfalls 147, 150, 151, 152, and 174) and WTD's 3rd Avenue West (DSN 008) and 11th Avenue Northwest (DSN 004) outfalls.

SPU is the lead agency for design and construction, and will own, operate, and maintain the tunnel and its related structures. (WTD will continue to own its two outfall structures.) WTD is coordinating with SPU on the project through a Joint Project Agreement (JPA) approved by the Seattle and County Councils in July 2016. The JPA guides implementation, operation, and cost-sharing of the Ship Canal Project. The County is providing funding and technical expertise and participates in the JPA-mandated Joint Oversight and Project Review and Change Management Committees.

This project is in both King County and the City of Seattle's CDs. For more information, see: http://www.seattle.gov/utilities/neighborhood-projects/ship-canal.

As project lead, more details are also provided in SPU's Annual CD/CSO Report.

Milestones	CD Milestone Date (Actual Date)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Submission of Draft Facilities Plan	3/31/2017 (1/15/2016)[1]													
Completion of Bidding	7/1/2021 (12/26/2019)[2]													
Construction Completion	12/31/2025[3] (N/A)													
Achievement of Performance Standard	12/31/2026[4] (N/A)													

Notes: 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 the joint City–County storage tunnel.

[1] The formal County submittal date was 1/22/2016.

[2] This was the completion of bidding for the tunnel construction contract, which, per Ecology, qualified as achieving this CD milestone. Bidding (Notice to Proceed) for the remaining major portions (pump station, conveyance, etc.) is projected to be completed by 2023.

[3] The CD calls for construction to be complete by the end of 2025. However, regulators have been notified that construction is behind schedule and will likely not be complete by the end of 2025. Both SPU and King County have submitted supporting information and documentation to regulators regarding the delay. No determination has yet been made or extension granted.

[4] Achievement of Performance Standard will follow one year after construction completion.

2022 Accomplishments

- Construction on all aspects of the Storage Tunnel construction contract continued. In April 2022, the large 18-foot (ft), 10-inch (in.) inside diameter tunnel boring machine (TBM) encountered a significant boulder. Mining operations were shut down for an extended period of time so that repairs could be made to the cutterhead. While the boring machine itself was not damaged, the cutting disks, etc. on the face of the machine required extensive repair. Once repairs were completed, mining activities continued and by the end of the year the machine was nearing the Fremont shaft, or approximately 9,000 ft out of the total 13,946 ft. Repairs were also completed to the 8-ft concrete pipe sections that make-up the microtunnel that crosses under the Ship Canal between the Fremont and Queen Anne drop shafts. At year's end, the microtunnel carrier pipe installation was over half complete. Non-tunnel work continued at all tunnel contract locations (Ballard, East Ballard, Fremont, Queen Anne, and Wallingford) on the diversion structures, mechanical and electrical facilities, pipelines, odor control, waterlines, tie-ins, site restoration, etc.
- The Tunnel Effluent Pump Station (TEPS) work package and Ballard Conveyance work package had previously been combined into one to aid in construction coordination and help reduce risks. The 100 percent design package was submitted to Ecology for review and approval. Final approval was received from the Seattle Design Commission. Advertisement documents were prepared.
- The Wallingford Conveyance contract was advertised and awarded in 2022. Actual construction activities started in January 2023.
- The Ship Canal Project completed hydraulic modeling of the North Queen Anne system to confirm that the project will not unacceptably impact the hydraulics of the system.
- Work continued on the Ship Canal Project O&M manual deliverable for the overall facility.

2022 Challenges and Corrections:

- In April 2022, the TBM encountered a large boulder, approximately 12-ft in diameter and 8-ft thick. This is believed to be the largest boulder ever encountered by a TBM in North American mining. The large-diameter tunnel mining is on the critical path and this issue delayed mining for approximately 3 months. The situation was analyzed and a strategy was developed to repair the damaged cutterhead and mine through the remaining portion of the boulder.
- Also in April 2022, the 100 percent estimate for the TEPS/Ballard Conveyance contract was prepared and it was approximately $30 million dollars higher than the 90 percent estimate prepared a year earlier. The increase was not due to scope change but rather material pricing and supply chain and labor issues. A subsequent review of the construction timetable indicated that these same issues would cause construction under this contract to take approximately 6 months longer than anticipated.

- The overall project budget and schedule had remained unchanged since 2018. By the end of 2022, it was apparent that the existing budget and schedule could not be achieved. COVID-19 impacts, mining productivity, material pricing, supply chain issues, labor availability, contractor vaccination mandate, encountering the large boulder, several smaller differing site conditions, the lengthened tunnel construction timeline along with the lengthened pump station construction timeline have all resulted in an approximately $70 million project cost increase and a schedule delay. Approximately 30 percent, or $21 million, will be funded by King County. The project team and contractors involved are working diligently to reduce costs and schedule wherever possible. The largest outstanding risk item is the TEPS/Ballard Conveyance bid amount. Bids are scheduled to open in spring 2023.
- Both SPU and King County are working with regulators to address the project delay and CD requirements, and have submitted force majeure notices and provided routine updates to address the potential effects of construction-related delays on the project milestones.

2023 Anticipated Activities

- The large-diameter tunnel is mining its final quadrant between the Fremont drop structure and the Wallingford structure. The TBM is scheduled to mine into the Wallingford shaft in late June 2023. The tunnel contractor will then begin removing all mechanisms from the tunnel that aided in its construction.
- Non-tunnel work will also continue at all tunnel contract locations (Ballard, East Ballard, Fremont, Queen Anne, and Wallingford) on the diversion structures, mechanical and electrical facilities, pipelines, odor control, waterlines, tie-ins, site restoration, etc.
- The microtunnel will be completed and the three interior pipes will be grouted in place.
- The Wallingford Conveyance contract is anticipated to begin construction in January 2023. Work will commence throughout the year.
- The TEPS/Ballard Conveyance contract will be advertised in early 2023, and bids are anticipated to be open in mid- 2023. Notice to Proceed is expected to be issued late 2023 after the tunnel contractor has completed their work and vacated the Ballard shaft. The Ballard shaft doubles as the pump station structure, and thus pump station construction cannot begin until it is fully vacated.
- Deliver project briefings at organizations, boards, and/or associations focused on potential project impacts to trees, bicycles, pedestrians, residents, and industry.
- Continue to deliver listserv updates, notices, and mailers along the tunnel alignment, as appropriate and necessary.
- Continue stakeholder briefings and attend community meetings.
- Provide project information via fact sheets, website, listserv, and other materials.

CD/CSO Report Project Status

West Duwamish CSO Control

CSO(s): DSN 038 (Terminal 115 Overflow) and DSN 042 (West Michigan Regulator Overflow)

Project Description: Construct a storage tank. For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/west-duwamish-cso-control.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Submission of Facilities Plan	12/31/2020 (12/22/2020)											
Completion of Bidding	12/31/2022 (N/A)											
Construction Completion	12/31/2025 (N/A)											
Achievement of Performance Standard	(N/A)											

2022 Accomplishments:

- Baseline Design, Cost, and Schedule
- Worked towards 60 percent design package
- State Environmental Policy Act checklist, comment period, and responses
- Final approval of the Facility Plan
- Worked on subplat division related to acquisition of proposed storage tank property
- Carried out quarterly sampling and analysis of soil and groundwater
- Amended engineering consultant contract through final design phase
- Continued community briefings through project website, mailings, and community events
- Evaluated schedule to incorporate expected impacts from negotiations in property acquisition and the requirements of the Prospective Purchaser Consent Decree
- Continued RainWise Program activities in South Park and Highland Park

2022 Challenges and Corrections:

- King County and Ecology continued confidential negotiations regarding the CD milestones.
- King County had conversations with Ecology's Toxic Cleanup Program regarding staff shortages related to review of analytical results of the soil and groundwater characterization of the parcel.

2023 Activities in Progress or Expected:

- Submittal of 60 percent design package, cost, and schedule
- Submittal of 90 percent design package, cost, and schedule
- Submittal and review responses of all construction-related permitting
- Procurement of Construction Management Services
- Submittal of draft Remedial Investigation/Feasibility Report to Ecology
- Submittal of draft Cleanup Plan to Ecology
- Continue acquisition of proposed storage tank property
- Completion of sampling and analysis of groundwater
- Continue community outreach and benefit activities
- Continue RainWise Program activities in South Park and Highland Park

CD/CSO Report Project Status

University Green Stormwater Infrastructure

CSO(s): DSN 015 (University RS Overflow)

Project Description: Construct GSI to minimize the gray infrastructure demands needed to achieve full CSO control. The timeline below corresponds to the CD's timeline for complete control of the University RS Overflow.

For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/university-gsi.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Submission of Facilities Plan[1]	12/31/2023 (N/A)												
Completion of Bidding	12/31/2025 (N/A)												
Construction Completion	12/31/2028 (N/A)												
Achievement of Performance Standard	N/A												

[1] An optional Green for Gray substitution report would be required by 12/31/22.

2022 Accomplishments:

- No further basin-scale GSI activities.
- RainWise activities continued in the University basin.

2022 Challenges and Corrections:

- None

2023 Activities in Progress or Expected:

- Project will be closed in 2023. RainWise activities will continue in the University basin under the RainWise program, and will continue to be reported separately (Section 2.7).

CD/CSO Report Project Status

Chelan Avenue CSO Control Project

CSO(s): DSN 036 (Chelan Ave. RS Overflow)

Project Description: This project will control the Chelan Avenue CSO to one event per year on a 20-year rolling average. On October 28, 2019, the County sent a letter to EPA and Ecology to formally request initiation of negotiations to modify the CD. The letter also requested a delay of two interim milestone dates associated with the Chelan Avenue CSO to match the milestones in the CD for the HLKK Wet Weather Station.

WTD will be evaluating control approaches for the Chelan Ave. CSO control project as part of the HLKK project-specific planning and design as requested in the October 2019 letter to EPA and Ecology.

For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/chelan-cso-control.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025
Submission of Facilities Plan	12/31/2018 (N/A)									
Completion of Bidding	12/31/2020 (N/A)									
Construction Completion	12/31/2023 (N/A)									
Achievement of Performance Standard	N/A									

2022 Accomplishments:

- The project to control the Chelan Ave. and HLKK outfalls was retitled the Mouth of Duwamish program.
- Problem definition for the Mouth of Duwamish program was completed and activities to transition the Mouth of Duwamish program to the project specific planning and design phase began in 2022.
- WTD will continue to coordinate with SPU throughout project specific planning and design phase.
- Continued negotiations with regulators regarding CD modification request.

2022 Challenges and Corrections:

- The Completion of Bidding milestone deadline of December 31, 2020 was missed. Official notification was sent to EPA and Ecology.

2023 Activities in Progress or Expected:

- Complete procurement for a program manager/owner advisor consultant and engineering and environmental consultant.
- Begin program establishment activities.
- Begin Mouth of Duwamish alternatives analysis for an engineering report.
- WTD will continue to coordinate with SPU throughout the Mouth of Duwamish project-specific planning and design.
- Continue negotiation with regulators regarding CD modification request.

CD/CSO Report Project Status

Hanford #2, Lander St., Kingdome, and King St. (HLKK) CSO Control Project

CSO(s): DSN 032 (Hanford #2 Outfall), DSN 030 (Lander St. Outfall), DSN 029 (Kingdome Outfall), and DSN 028 (King St. Outfall)

Project Description: The HLKK CSO control project will control CSOs from WTDs Hanford #2 (DSN 032), Lander St. (DSN 030), Kingdome (DSN 029), and King St. (DSN 028). On October 28, 2019, the County sent a letter to EPA and Ecology to formally request initiation of negotiations to modify the CD. The letter also requested delay of two interim milestone dates associated with the Chelan Avenue CSO to match the milestones in the CD for the HLKK Wet Weather Station.

WTD began activities to move the HLKK CSO control project to project-specific planning and design in 2022. WTD will be evaluating control approaches for the Chelan Ave. CSO control project with the HLKK project-specific planning and design as requested in the October 2019 letter to EPA and Ecology.

Milestones	CD Milestone Date (Actual Date)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Submission of Facilities Plan[1]	12/31/2024												
Completion of Bidding	12/31/2026												
Construction Completion	12/31/2030												
Achievement of Performance Standard	4/30/2033												

2022 Accomplishments:

- The project to control the Chelan Ave. and HLKK outfalls was retitled the Mouth of Duwamish program.
- Problem definition for the Mouth of Duwamish program was completed and activities to transition the Mouth of Duwamish program to the project specific planning and design phase began in 2022.

• WTD will continue to coordinate with SPU throughout project specific planning and design phase. • Continued negotiations with regulators regarding CD modification request.
2022 Challenges and Corrections: • None
2023 Activities in Progress or Expected: • Complete procurement for a program manager/owner advisor consultant and engineering and environmental consultant. • Begin program establishment activities. • Begin Mouth of Duwamish alternatives analysis for an engineering report. • WTD will continue to coordinate with SPU throughout the Mouth of Duwamish project-specific planning and design. • Continue negotiation with regulators regarding CD modification request.

4.1 Supplemental Compliance Plan Summaries

Supplemental Compliance Plans are documents that describe remedial measures King County will take to achieve CSO control for completed CSO control projects. According to the 2013 CD, Supplemental Compliance Plans are required when:

- CSO control projects are not constructed in accordance with design criteria set forth in the CD,
- King County is not complying with all requirements of its NPDES permit pertaining to CSOs, or
- The CSO control project does not result in meeting the CSO control performance standard of no more than one overflow event per year on a 20-year moving average.

To date, King County has only developed supplemental compliance plans for CSO control projects that did not result in meeting the CSO control performance standard. A status page for each project under a Supplemental Compliance Plan follows Table 5 (“Summary of King County Supplemental Compliance Plans”) and provides updates for each of King County’s Supplemental Compliance Plans.

A Supplemental Compliance Plan was submitted for the Dexter and Harbor CSO outfalls in 2013. An amendment to the Harbor Supplemental Compliance Plan was submitted in 2016 with additional remedial actions. Those plans are complete, and Dexter and Harbor are now in control.

Projects with active Supplemental Compliance Plans include:

- Barton St. PS Overflow

- Denny Way RS Overflow
- Hanford #1 CSO
- South Magnolia Wet Weather Storage and Pipeline

In December 2017, King County submitted a CSO compliance actions letter to Ecology acknowledging that the Belvoir PS outfall does not meet the CSO control performance standards as specified in the NPDES permit and CD. WTD is committed to working closely with SPU to support completion of operational and capital improvements underway. All necessary steps needed to bring Belvoir PS into compliance will be completed by the end of the consent decree. The County also submitted a letter to Ecology in May 2018 acknowledging that the 63rd Ave. SW PS outfall does not meet the CSO control performance standard. The letter provided information on actions the County will be taking so that the 63rd Ave. SW PS will meet the performance standard by December 31, 2030.

Table 5. Summary of King County Supplemental Compliance Plans

CSO Name (Project Name)	DSN	Supplemental Compliance Plan Background	Outfall Status
Barton St. PS (Barton Street Roadside Raingardens and Barton St. PS Upgrades)	057	Supplemental Compliance Plan submitted to Ecology April 23, 2018. An amendment to the Supplemental Compliance Plan was submitted on August 30, 2022. Control status to be reported in Annual Reports.	Additional remedial actions are underway; performance of the outfall will continue to be monitored.
South Magnolia (South Magnolia Wet Weather Storage Project)	006	Supplemental Compliance Plan submitted to Ecology January 30, 2017. Addendum submitted on April 24, 2018; an amendment to the Supplemental Compliance Plan was submitted on August 30, 2022.	Additional remedial actions are underway; performance of the outfall will continue to be monitored.
Dexter Ave. RS (Dexter Ave. Supplemental Compliance Plan)	009	Supplemental Compliance Plan submitted August 2013; control status to be reported in Annual Reports.	Outfall controlled in 2016.

CSO Name (Project Name)	DSN	Supplemental Compliance Plan Background	Outfall Status
Denny Way RS (Denny Way Supplemental Compliance Plan)	027a	Supplemental Compliance Plan submitted to Ecology August 2, 2013. Revised Supplemental Compliance Plan submitted August 31, 2016; An amendment to the Supplemental Compliance Plan was submitted on August 30, 2022.	Additional remedial actions are underway; performance of the outfall will continue to be monitored.
Hanford #1 CSO (Rainier Valley Wet Weather Storage)	031	Supplemental Compliance Plan submitted to Ecology August 28, 2020. Work detailed in the Supplemental Compliance Plan is continuing.	Initial remedial actions are underway; performance of the outfall will continue to be monitored.
Harbor Ave. RS (Harbor Ave. Supplemental Compliance Plan)	037	Supplemental Compliance Plan submitted to Ecology July 3, 2013. Revised Plan submitted August 31, 2016; an amendment to the Supplemental Compliance Plan was submitted on August 30, 2022, and control status to be reported in Annual Reports.	Outfall controlled in 2022.

CD/CSO Report Supplemental Compliance Plan

Barton St. Roadside Raingardens

CSO(s): DSN 057 (Barton St. PS Overflow)

Project Description: Construct GSI (bioretention swales and associated drainage structures) and underground injection control wells for CSO control. The project did not initially meet the performance standard (an average of one uncontrolled CSO event per year on a 20-year moving average), and King County submitted a supplemental compliance plan in April 2018. Modeling and monitoring indicate that this outfall is close to compliance. The County is planning to investigate additional GSI throughout the Barton basin to further reduce overflows and will continue monitoring to confirm achievement of the performance standard.

For more information, see:
https://kingcounty.gov/~/media/depts/dnrp/wtd/capital-projects/COMPLETED/PDF/Barton-street-pump-station-upgrade-2015.ashx.

2022 Accomplishments:

- Submitted an amendment to the Supplemental Compliance Plan detailing additional remedial actions.

2022 Challenges and Corrections:

- The pumps at the Barton pump station are underperforming and peak pumping capacity continues to be diminished.

2023 Activities in Progress or Expected:

- Receive EPA and Ecology approval or disapproval of the amendment to the Supplemental Compliance plan.
- Review pump operation and control strategy at the Barton PS during 2022 events.
- Re-open the Barton RainWise basin to allow additional installations.
- Continue monitoring for achievement of the performance standard.

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 (Technical Memorandum) 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 ft 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 and monitored over two wet seasons. Model updates were completed in 2019. After additional monitoring, it has been determined that the outfall is not yet in compliance. Additional remedial actions have been developed, and an updated Supplemental Compliance Plan was submitted in August 2022.

2022 Activities:

- Submitted an amendment to the Supplemental Compliance Plan detailing additional remedial actions.

2022 Challenges and Corrections:

- More monitoring information is needed to gain certainty and confirm achievement of the performance standard.

2023 Activities in Progress or Expected:

- Receive EPA and Ecology approval or disapproval of the amendment to the Supplemental Compliance plan.
- Investigate raising Interbay weir crest height through modeling to determine feasibility.
- Continue monitoring for achievement of the performance standard.

CD/CSO Report Supplemental Compliance Plan Status

Hanford #1

CSO(s): DSN 031 (Hanford #1 Overflow - Hanford @ Rainier Overflow, Bayview North Overflow, and Bayview South Overflow)

Project Description: The project achieved substantial completion in 2018 and completed its first full year of monitoring. The project recorded two events in 2019, and modeling indicates the project did not achieve the performance standard. WTD submitted a Supplemental Compliance Plan in August 2020.

For more information, see:
https://kingcounty.gov/~/media/depts/dnrp/wtd/capital-projects/COMPLETED/PDF/Rainier-valley-wet-weather-storage-2018.ashx.

2022 Accomplishments:

- Expanded collection of flow data further upstream and downstream of Bayview structures by installing seven additional flow monitors.
- Continued collecting additional flow data during the 2022 to 2023 wet season.
- Inspected Bayview and Hanford Tunnels for potential obstructions.
- Inspected flapgate and bubblers at Hanford at Rainier overflow structure to confirm proper functioning.

2022 Challenges and Corrections:

- The project will assess its status as remedial actions are completed.

2023 Activities in Progress or Expected:

- Complete 2022 to 2023 wet season flow data collection.
- Conduct additional flow data analysis and related flow model adjustments.
- Assess potential operational improvements.

CD/CSO Report Supplemental Compliance Plan Status

South Magnolia Wet Weather Storage and Pipeline

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 was submitted in January 2017 to comply with the CD deadline for notifications. King County completed all commitments in the Revised Supplemental Compliance Plan. After additional monitoring, it has been determined that the outfall is not yet in compliance. Additional remedial actions have been developed, and an updated Supplemental Compliance Plan was submitted in August 2022.

For more information, see:
https://kingcounty.gov/depts/dnrp/wtd/capital-projects/completed/magnolia-wet-weather-storage-facility.aspx.

2022 Accomplishments:

- Submitted an amendment to the Supplemental Compliance Plan detailing additional remedial actions.

2022 Challenges and Corrections:

- Data continues to indicate the storage facility is not being fully utilized during wet weather events.

2023 Activities in Progress or Expected:

- Receive EPA and Ecology approval or disapproval of the amendment to the Supplemental Compliance Plan.
- Investigate reducing the EDS low flow gate to reduce the volume of flow being sent to the 18-inch South Magnolia Trunk to better use storage capacity.
- Continue monitoring for achievement of performance standard.
- Additional modeling is planned to confirm the model is calibrated and validated. Additional updates may be made to reflect operational strategy adjustments and observed conditions.

4.2 Program Plan Summaries

The CD required development and implementation of two plans: the SSOP and the JOSOP with the City of Seattle.

4.2.1 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 embedded 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 and SharePoint sites. Representatives from Operations, Off-Site, and CSO control planning continue to review the plan regularly to ensure the electronic links still work and base documents are being updated as needed.

4.2.2 Joint Operations and System Optimization Plan

The City of Seattle's and King County's CDs direct both agencies to work together to develop a JOSOP and to review it every three years and update it as necessary. In developing the original JOSOP (submitted to EPA and Ecology in February 2016), DNRP and SPU staff 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 reviewed, updated, and approved by SPU's Drainage and Wastewater Line of Business Branch Executive and DNRP's WTD Director, and included in the JOSOP Update submitted to EPA and Ecology in January 2019.

The following list describes each commitment and the progress made in 2022:

- The Joint System Event Debrief Committee commitment includes preparing for the wet season and debriefing after major storm events to exchange information, reviewing and updating emergency communication protocols between the agencies, discussing meteorological data, evaluating CSO performance, and assessing operational decision impacts on the combined system. To coordinate for the 2022/2023 wet season, a meeting was held in September 2022 to discuss pre-season maintenance activities, system changes, meteorological information, and emergency communication protocols.
- The Data Sharing commitment includes supporting a Joint Operations Information Sharing Team (JOIST), implementing a pilot project for sharing real-time SCADA data, developing data sharing protocols, and improving the regional ability to forecast storms and rainfall intensities.
- JOIST held two meetings during which SPU and DNRP staff shared information on the operation of existing facilities, progress of capital projects, and coordination of Joint Plan commitments.

- SPU and DNRP held two workshops as part of the annual process to review flow monitoring data collected by each agency and provide recommendations for future monitoring.
- In 2022, SPU and DNRP signed and approved a data sharing Memorandum of Agreement. SPU and DNRP are in process of implementing the recommended upgrades to the data sharing platform.
- The Joint Modeling Coordination Committee commitment includes sharing modeling tools and increasing understanding of modeling analyses and system operations while developing stronger working relationships between DNRP and SPU modeling staff and improving efficiencies through better coordination efforts. Members of the Joint Modeling Coordination Committee held meetings in 2022 to review modeling results and coordinate model developments between each agency. In 2022, we updated the Joint Modeling Coordination Committee Charter to reflect how we coordinate modeling activities. The North Interceptor/Ship Canal model was updated per the 100 percent drawings. The model was utilized to develop and propose a revised discharge control scheme for TEPS, and to model and describe the potential impact of influent gate failures during a filling event. In addition, SPU and DNRP shared modeling results from the S Magnolia CSO basin and SPU presented an update on their South Magnolia SWMM model. The DNRP System Model was updated to include the recent SPU Central Waterfront project, the Georgetown WWTS, and an improved Interbay PS control algorithm. The joint modeling work plan, initially developed in 2018, was updated to reflect current and future work. This plan will continue to provide a framework for coordination and communication for upcoming modeling work.
- The Coordination during Startup and Commissioning of CSO Control Facilities commitment includes conducting document review, attending commissioning meetings, and implementing data sharing for SPU and DNRP CSO control facilities. In 2022, SPU commissioned Wastewater Pump Station 17 (Beacon Hill) and Wastewater Pump Station 38 (West Seattle), and provided an overview to DNRP during a JOIST meeting.
- The Real-Time CSO Notification commitment includes revising both agencies' on-site signs and website information to improve notification of CSO events and communication with customers.
- The Reduce Saltwater Intrusion commitment involves continuing to work together on studies, data, and solutions for reducing intrusion. In 2022, SPU and DNRP continued to discuss strategies and actions for reducing saltwater intrusion.
- WTD and SPU completed the second update of the JOSOP, focusing on the progress made to each of the areas depicted above. The second update of the JOSOP was submitted to EPA and Ecology on February 28, 2022.

4.2.3 WTD and SPU Coordination on CSO Control Projects

WTD and SPU have been working together for many years to identify collaborative project and operational opportunities to improve each agency's efforts and to better protect public health and the environment. The two agencies have agreed to guiding principles to ensure that neither agency will adversely impact the compliance of the other. Given that SPU's combined sewers are upstream of King County's system, new or improved SPU CSO control facilities have the potential to affect flows in King County's regional system. For this reason, SPU and WTD coordinate before and after construction of capital projects. Below is a list of projects constructed by SPU in recent years:

- Delridge Basin 99 CSO Sewer System Improvement Project – SPU commissioned the project in 2019 and provided an overview to DNRP during a JOIST meeting.
- Central Waterfront Project (SPU basins 70, 71, and 72) – Following removal of the Alaskan Way Viaduct, SPU is eliminating two CSO locations and providing conveyance and storage to control two other CSO outfalls. Construction is underway and substantial completion is expected in early 2024. More flows will be conveyed to WTD's Elliott Bay Interceptor as a result of the project. Monitoring is in place to confirm expected flow changes, and WTD continued modeling the changes and impacts to the downstream system in 2022.
- SPU Pump Station 22 (SPU Basin 60) was upgraded from 0.86 MGD to 4 MGD in 2020.
- SPU Pump Station 20 in Portage Bay was upgraded from 1.1 MGD to 1.5 MGD in 2020.
- SPU Pump Station 13 in East Montlake (SPU Basin 20) was upgraded from 0.9 MGD to 2.8 MGD in 2021.

WTD and SPU have flow monitoring in place for those Seattle projects with the potential to impact flows in the regional system. Flow data are collected and reviewed annually to determine if flow monitoring adjustments need to occur. WTD will continue working with SPU on control and operational strategies as SPU starts up any new facilities and continues operating its existing facilities.

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 signed by the two agencies in 2013. The term "GSI" describes a variety of measures that manage urban runoff by using nature-based processes to slow, detain, or retain stormwater. The goals of the County's GSI work are to reduce polluted runoff entering the CSO system and/or nearby waterways while also delivering a range of risk reduction and community co-benefits. GSI bioretention facilities in the right-of-way also are referred to as "natural drainage systems." GSI can also be a component of low impact development. Collaborative work between WTD and SPU in 2022 included:

- Conducted UIC Well inspection training.

- Finalized pre-settling guidance.
- Developed draft guidance for underdrain inlet design.
- Coordination with SPU on a re-evaluation of control options for King County's Mouth of Duwamish outfalls as well as opportunities to perform joint planning and project delivery to address nearby SPU outfalls.
- Development of new performance metrics for RainWise installations to capture larger storm events.

In 2023, planned collaborative work includes:

- Developing design standards for weirs.
- Developing guidance for conveyance swale design and applicability.
- Continued coordination with SPU for King County's Mouth of Duwamish outfalls as well as opportunities to perform joint project delivery to address nearby SPU outfalls.
- Ongoing coordination wherever close system relationships present the opportunity, including current projects in design (such as West Duwamish) and future projects still in planning (such as University and Montlake CSO control).
- 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 and SPU Basins 147, 150/151, 152, and 174. Coordination for this project is ongoing, and its status is described in Section 4 of this report.
- RainWise rebate increase and launch of new performance metric requirements.

5 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 West Point. 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 and reports on unpermitted overflows and summarizes frequency and volume for all untreated and treated CSO discharges in 2022. Additional information can be found in the appendices of this report.

5.1 Annual Rainfall

Rainfall data are reported for each CSO event as measured by the nearest King County-owned rain gauge. Appendices A and B include rainfall data for 2022. The annual rainfall for 2022, as an average over local rain gauges, was 32.55 in. The annual rainfall at SeaTac International Airport was 40.27 in., which is slightly above the 20-year SeaTac annual average of 40.06 in, according to National Oceanic and Atmospheric Administration data collected at the time of report writing. Long-term, WTD will be looking at how storms over the last 20 years may compare to storms of the next 60 years. WTD is funding work by the University of Washington Climate Impacts Group to analyze impacts on precipitation over the next century.

5.2 Unpermitted Overflows

Overflows can occur from CSO structures and outfalls, broken pipelines, and maintenance holes. The County characterizes three types of unpermitted overflows: dry weather overflows (DWOs), exacerbated CSOs (eCSOs), or sanitary sewer overflows (SSOs).

Any overflow in the combined system from a designated CSO outfall that occurs beyond 24 hours after rainfall has ceased is called a DWO. In King County's system, when DWOs occur, they are usually a result of mechanical failures, power outages, or human error. Per EPA's Nine Minimum Controls and the West Point NPDES permit, DWOs are prohibited. Overflows in controlled or uncontrolled basins from 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 "SSOs" by the County. Additionally, the CD defines a "sewer overflow" as "any overflow, spill, diversion, or release of wastewater from or caused by the Sanitary Sewer System or the Combined Sewer System upstream of a County's CSO Outfall" and including discharges to water bodies or discharges to land (i.e., public or private property). The County responds to sewer backups in buildings to determine if they are caused by

failures of equipment or operations, or if they are associated with private property circumstances. WTD strives to avoid and alleviate conditions that may result in backups, and assists property owners when backups occur as a result of conditions in the County's system.

Unpermitted overflows that occurred in 2022 as a result of any incident in the County's CSO system are shown in Table 6. In 2022, there was one exacerbated CSO (Montlake Regulator) and one DWO (East Pine Pump Station). There were also three relatively small SSOs, in which two had discharges that entered Puget Sound, and one that was contained on land.

Table 6. Summary of Unpermitted Overflows in 2022

Date of Event	Facility	Description of Violation(s)
1/3/22–1/4/22	Montlake Ave. Regulator Station	Exacerbated CSO overflow: During a storm event and CSO overflow, the CSO outfall gate opened as designed, but remained 30% open as it closed due to a faulty contactor.
3/3/22	Murray Ave. Pump Station	SSO: Leak in east force main (#1) surfaced to street level and flowed to a City stormwater catch basin and discharged to Puget Sound from the offshore outfall.
3/8/22	Harbor Ave Regulator	SSO: Leak from open drain valve on air relief valve (ARV) that was potentially bumped open. Leak was contained on-site.
8/22/22	East Pine Pump Station	DWO: The station experienced a power failure and the generator failed to start. With no pumping, the station started to overflow after storage was exhausted.
11/26/22–11/27/22	Barton Street Pump Station	SSO: Leak from an ARV on one of the station's force mains, with overland flow to a beach. The ARV likely malfunctioned because the float did not fully seat due to debris.

In coordination with SPU, WTD continued efforts in 2022 to reduce backups in the area of South Park upstream from the County's 8th Ave. S Regulator Station that have occurred in past years during larger storm events. Additionally, during a storm event that took place December 25 to 27, 2022, there was a major flooding event when the Duwamish River overtopped its banks due to a combination of king tides, pre-spring snowmelt, a low barometric pressure system, strong onshore westerly winds, and stormwater runoff. The County's preliminary investigation results indicate considerable floodwater entered the County's sewer system, and SPU's investigations indicated there was anecdotal information that some residences in the flooded area experienced sewer backups. The City of Seattle and King County responded to assist residents affected by the flooding in 2022 and coordinated with property owners that are vulnerable to backups to install backup prevention equipment. The County modified a sewer junction in late 2021, upstream of the 8th Ave. S. facility to reduce the potential constriction of flow, and modified the 8th Ave. S. outfall gate set point in February 2022. The County

currently has a project to evaluate options to adapt our wastewater system as severe storms, higher tides, and sea level rise bring more water to the South Park neighborhood.

5.3 Annual Untreated CSO Events

West Point's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at 12 CSO locations not currently monitored by SCADA or to supplement SCADA monitoring: 11th Ave. NW Overflow, 3rd Ave. W and Ewing Street Overflow, 30th Ave. NE Overflow, Southwest Alaska Street Overflow (SW Alaska St. Overflow), Hanford #1 (Bayview North Overflow, Bayview South Overflow, Hanford @ Rainier Overflow), East Duwamish Pump Station Overflow (E Duwamish PS Overflow), W Duwamish Overflow, S Magnolia Overflow, North Beach PS Inlet Overflow, and Terminal 115 Overflow.

In 2022, there were 29 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 2022 resulted in 160 untreated CSO events discharging about 1,664 MG. Rainfall in 2022 was higher than normal, resulting in a total discharge volume that was higher than predicted in an average year. The highest precipitation occurred in December (7.55 in.) and resulted in 40 untreated events totaling 428 MG. The second highest precipitation occurred in January (7.06 in.), resulting in 48 untreated events and an overflow volume of 837 MG.

Appendix A lists the untreated events from County CSOs during 2022. These data are also provided to Ecology in electronic form alongside this report.

5.4 CSO Treatment

King County provides CSO treatment, defined in Chapter 173-245 WAC as "equivalent to primary" treatment and disinfection, at West Point for flows above its secondary capacity of 300 MGD and at four satellite facilities: Alki, Carkeek, Elliott West, and Henderson/MLK Jr. Way WWTSs. A fifth satellite facility, the Georgetown WWTS, was brought online at the end of 2022, and reporting for that facility will begin in next year's annual report.

The following sections summarize performance and compliance at each facility during 2022. Appendix B of this report provides more detail on volumes and events. Appendices C through F contain the annual reports for each WWTS.

5.4.1 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), West Point provides primary treatment plus disinfection/dechlorination for flows above 300 MGD and up to a designed instantaneous peak of 440 MGD. Where captured flows into King County's conveyance system cannot be conveyed to regional treatment plants because of conveyance system limitations, flows are conveyed to WWTSs or are discharged untreated. West Point flows in excess of 300 MGD and up to 440 MGD receive primary treatment and are blended 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 (i.e., 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 wet weather flows, and reduces program costs and impacts to local water bodies. West Point had 18 wet weather treatment events during 2022, where peak flows received primary treatment prior to blending with secondary treated flows, disinfection, dechlorination, and discharge. The total volume of flows that exceeded 300 MGD and received primary treatment only was 247.71 MG. All occurrences are listed in Appendix B.

Occasionally during either dry or wet weather conditions, power and equipment failures can result in secondary diversions that occur via CSO gates at West Point. During such events, flow from the primary treatment bypasses the secondary treatment system directly to the chlorine disinfection basins, and all final effluent is dechlorinated as usual. Secondary diversions are necessary to prevent exposure of workers to safety hazards and facility damage. In 2022, there was one secondary diversion totaling 1.54 MG that was the result of a plant-wide power outage causing the diversion gates to open. This secondary diversion was a short duration event, where the bypassed flow mixes with substantial ongoing secondary treated flows entering the disinfection basin. The secondary diversion event did not result in exceedances of permit effluent limits in the final effluent that is discharged to Puget Sound.

5.4.2 Alki Wet Weather Treatment Station

The transfer of Alki area base flows to West Point 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 2022, there were nine filling events and six discharge events. The Alki WWTS received 108.8 MG of influent flow and discharged 93.2 MG.

Overall, TSS removal was 37percent for 2022, which did not meet the annual average 50 percent TSS removal limit. Alki was compliant with all permit conditions in 2022 except for the annual TSS removal and daily minimum pH less than 6.0 on two occasions. The annual average settleable solids (SS) was 0.10 milliliter per liter per

hour (ml/L/hr), which met the SS limit of 0.3 ml/L/hr. The Alki WWTS complied with the instantaneous maximum pH of over 9.0. In addition, Alki's effluent met the daily maximum average total residual chlorine (TRC) permit limit of 234 micrograms per liter (µg/L) on all 10 discharge days. Alki WWTS met the monthly fecal coliform geomean permit limit of 400 counts per 100 mL during the three months of discharge at Alki WWTS. Appendix C contains more details on the Alki WWTS.

5.4.3 Carkeek Wet Weather Treatment Station

The transfer of Carkeek area base flows to West Point and the conversion of the Carkeek Treatment Plant from a continuously operating primary plant to a WWTS was completed in 1994. In 2022, Carkeek WWTS had eight filling events and five discharge events. The Carkeek WWTS received 39.1 MG and discharged 35.5 MG.
Overall, TSS percent removal was 50 percent in 2022, thereby meeting the NPDES permit limit of 50 percent for annual average removal. Carkeek WWTS met its annual average SS limit, with the average measuring 0.15 ml/L/hr (with the NPDES permit limit being 0.3 ml/L/hr).

Carkeek WWTS did not meet the instantaneous minimum pH of 6.0 once out of 11 days of discharges; it did meet the instantaneous maximum pH limit of 9.0 for all discharge days. The daily maximum average TRC exceeded the permitted level of 490 µg/L on five of 11 discharge days; it reached as high as 4572 µg/L. The facility also experienced disinfection failures during events in January, February, and December. Additionally, the effluent fecal coliform geomean was greater than 400 cfu/100 mL due to the failure in February, with a maximum value of 2,133,073 cfu/100 mL. All remaining NPDES permit limits were met at Carkeek WWTS. Appendix D contains more details on the Carkeek WWTS.

5.4.4 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 2022, there were 36 inflow events totaling 474.3 MG and 12 discharge events totaling 291.2 MG that were treated and discharged through the Elliott West Outfall at the Denny Way RS.

Overall, TSS removal averaged 39 percent for the year, thereby not meeting the NPDES 50 percent annual average TSS removal limit. Elliott West WWTS did not meet the SS annual event average limit, with the average measured as 1.9 ml/L/hr and the NPDES permit limit being 0.3 ml/L/hr. Daily average TRC exceeded the permitted level of 109 µg/L on 11 of 18 discharge days; it reached as high as 4354 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on 12 of the 18 discharge days; it reached as low as pH 3.5 during a large December 24 to 27, 2022 event. The facility experienced two disinfection failures during events in January and June, and the effluent fecal coliform geomean was greater than 400 cfu/100 mL as a result of the failure in June, with a maximum value of 4,469 cfu/100 mL. All required samples were

collected, and all required measurements were completed in 2022. Appendix E contains more details on the Elliott West WWTS.

5.4.5 Henderson/MLK Jr. Way Wet Weather Treatment Station

The Henderson/MLK Jr. Way WWTS was brought online in May 2005. There were five filling events and three discharge events at the Henderson/MLK Jr. Way WWTS in 2022. The treatment facility received 31.09 MG of combined sewer wastewater and discharged 19.70 MG of treated water to the Duwamish Waterway. The Henderson/MLK Jr. Way WWTS complied with all permit effluent and performance limits in 2022 except for total chlorine residual on January 2. Appendix F contains more details on the Henderson/MLK Jr. Way WWTS.

6 Summary of Consent Decree and NPDES Violations in 2022

Section VIII. 43 of the CD requires the listing of any violations of the CD in the annual report. Table 7 identifies CD violations in 2022 and related exceedances of NPDES wet weather permit requirements for the CSO system. Appendices C through F contain details on the causes and corrective actions taken. All notifications to Ecology were made in a timely manner.

Table 7. Summary of Effluent Limitation* and Consent Decree Violations in 2022

Date of Event	Facility	Description of Violation(s) *
1/2/22	H/MLK WWTS	Total chlorine residual
1/2–3/22	Elliott West WWTS	Total chlorine residual (x2), pH (x2)
1/2–4/22	Carkeek WWTS	Total chlorine residual (x3)
1/5–7/22	Elliott West WWTS	Total chlorine residual (x2), pH (x2)
1/6/22	Elliott West WWTS	Disinfection failure
1/5–7/22	Carkeek WWTS	Total chlorine residual
1/7/22	Carkeek WWTS	Disinfection failure
2/27–28/22	Elliott West WWTS	Total chlorine residual (x2), pH (x2)
2/27/22	Alki WWTS	pH
2/28/22	Carkeek WWTS	Disinfection failure
February 2022	Carkeek WWTS	Fecal coliform
4/3/22	Elliott West WWTS	Total chlorine residual
6/5/22	Elliott West WWTS	Disinfection failure
June 2022	Elliott West WWTS	Fecal coliform
11/6/22	Elliott West WWTS	Total chlorine residual (x2), pH (x2)
11/22/22	Elliott West WWTS	Total chlorine residual, pH (x2)
12/24/22	Elliott West WWTS	Total chlorine residual, pH
12/24/22	Alki WWTS	pH
12/24/22	Carkeek WWTS	Disinfection failure
12/25–27/22	Elliott West WWTS	Total chlorine residual, pH (x3)
12/27/22	Alki WWTS	pH
2022 annual	Elliott West WWTS	Annual average Total Suspended Solids (TSS) removal
2022 annual	Elliott West WWTS	Annual average Settleable Solids
2022 annual	Alki WWTS	Annual average TSS removal

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

7 Post-Construction Monitoring

King County's PCMP was approved by Ecology on September 28, 2012. Monitoring volume and frequency of overflows at the controlled untreated discharge locations listed above in Table 7 is ongoing, reported monthly to Ecology, and summarized in each CSO Annual Report (Appendix A). Volume, frequency, and NPDES permit effluent monitoring and effluent compliance for the WWTSs 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") as revised in 2022 (King County 2022). All monitoring is currently up to date. No post-construction sediment monitoring was required in 2022.

A post-construction monitoring report required under NPDES permit condition S11.F(d) was submitted to Ecology on November 26, 2019. The report demonstrates how CSO outfalls that were controlled prior to permit issuance, as well as CSOs brought under control during the permit term, achieve performance requirements and comply with the state's water quality and Sediment Management Standards (SMS). For outfalls with SMS exceedances associated with CSO discharges, the report describes cleanup activities in the vicinity, including cleanup actions planned or that have been performed, targeted chemicals, any available pre- and post-cleanup monitoring results, cleanup project schedule, post-project monitoring schedule, and a list of parties involved.

Appendices

Appendix A: Untreated CSO Events, January–December 2022

Appendix B: Treated CSO Events, January–December 2022

Appendix C: Alki Wet Weather Treatment Station 2022 Annual Report

Appendix D: Carkeek Wet Weather Treatment Station 2022 Annual Report

Appendix E: Elliott West Wet Weather Treatment Station 2022 Annual Report

Appendix F: Henderson/MLK Jr. Way Wet Weather Treatment Station 2022 Annual Report

Appendix A
Untreated CSO Events

January–December 2022

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	1/2/22 6:18 PM	1/3/22 3:31 AM	9.22	5,246,033	2.40	20.95	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	1/6/22 1:06 AM	1/7/22 1:42 PM	36.60	1,232,237	5.36	127.27	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	1/11/22 1:42 AM	1/11/22 2:38 AM	0.93	129,408	0.54	18.77	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	4/4/22 1:17 AM	4/4/22 3:20 AM	2.05	72,955	0.75	8.38	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	5/29/22 2:49 PM	5/29/22 3:34 PM	0.75	60,089	0.57	23.38	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	11/6/22 6:16 AM	11/6/22 6:49 AM	0.55	31,156	0.62	5.02	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	11/29/22 9:20 PM	11/29/22 10:27 PM	1.12	155,043	0.77	12.18	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	12/24/22 8:09 AM	12/27/22 8:51 PM	84.70	2,937,898	4.74	101.33	
004	East Ballard (AKA 11th Ave. NW)	Lake Washington Ship Canal	12/29/22 11:49 PM	12/30/22 1:01 AM	1.20	155,043	0.5	26.8	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/2/22 7:25 PM	1/3/22 3:35 AM	8.17	398,886	1.89	16.02	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/7/22 7:05 AM	1/7/22 1:55 PM	6.83	248,319	4.71	122.13	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/27/22 7:20 AM	12/27/22 8:05 AM	0.75	11,673	1.85	87.6	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	1/2/22 7:30 PM	1/3/22 4:41 AM	9.18	13,682,732	2.42	21.68	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	1/6/22 6:25 PM	1/7/22 1:50 PM	19.42	2,898,379	5.36	127.27	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	1/11/22 2:55 AM	1/11/22 3:05 AM	0.17	49	2.41	18.77	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	2/27/22 10:29 PM	2/28/22 5:38 PM	19.15	5,260,971	3.02	49.52	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	4/4/22 1:43 AM	4/4/22 3:55 AM	2.20	1,594,289	0.75	8.38	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	6/5/22 8:35 AM	6/5/22 8:50 AM	0.25	115,183	1.02	62.82	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	10/31/22 1:38 AM	10/31/22 2:26 AM	0.80	46,418	0.71	5.33	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	11/6/22 7:38 AM	11/6/22 8:47 AM	1.15	272,100	0.75	6.28	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	12/24/22 9:54 AM	12/27/22 11:05 AM	73.18	5,137,246	4.49	91.33	
008	3rd Ave. W and Ewing St.	Lake Washington Ship Canal	12/30/22 12:48 AM	12/30/22 2:59 AM	2.18	651,130	0.62	28.48	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
011	E Pine St. Pump Station Emergency Overflow	Lake Washington			0.57	15,000–20,000			8/22/22 DWO Refer to ERTS
012	Belvoir Pump Station Emergency Overflow	Lake Washington	1/2/22 9:25 PM	1/3/22 2:04 AM	4.65	517,278	2.13	15.38	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	1/7/22 12:54 PM	1/7/22 1:40 PM	0.77	16,996	4.06	122.77	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	2/28/22 7:52 AM	2/28/22 8:51 AM	0.98	28,764	2.43	45.33	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	12/24/22 10:14 AM	12/24/22 11:36 AM	1.37	94,628	1.39	19.23	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	12/25/22 11:59 PM	12/26/22 12:47 AM	0.80	21,218	2.66	56.43	
014	Montlake Overflow	Lake Washington Ship Canal	1/2/22 10:17 PM	1/2/22 11:35 PM	1.30	230,545	1.78	12.92	
014	Montlake Overflow	Lake Washington Ship Canal	1/2/22 11:35 PM	1/4/22 12:15 PM	36.67	20,730,000			eCSO Refer to Table 6
014	Montlake Overflow	Lake Washington Ship Canal	1/6/22 10:38 PM	1/7/22 12:26 PM	13.80	2,758,421	2.90	121.77	
014	Montlake Overflow	Lake Washington Ship Canal	2/27/22 10:19 PM	2/28/22 6:22 PM	20.05	12,814,989	2.06	49.87	
014	Montlake Overflow	Lake Washington Ship Canal	5/29/22 3:27 PM	5/29/22 3:45 PM	0.30	253,591	0.49	23.63	
014	Montlake Overflow	Lake Washington Ship Canal	6/5/22 8:46 AM	6/5/22 9:10 AM	0.40	982,313	0.99	13.65	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
014	Montlake Overflow	Lake Washington Ship Canal	6/9/22 3:16 PM	6/9/22 4:31 PM	1.25	965,360	0.65	9.53	
014	Montlake Overflow	Lake Washington Ship Canal	10/30/22 11:53 PM	10/31/22 1:19 AM	1.43	1,495,260	0.52	3.95	
014	Montlake Overflow	Lake Washington Ship Canal	11/6/22 7:18 AM	11/6/22 8:32 AM	1.23	1,310,063	1.14	6.60	
014	Montlake Overflow	Lake Washington Ship Canal	11/22/22 12:02 PM	11/22/22 1:25 PM	1.38	2,176,676	0.95	7.40	
014	Montlake Overflow	Lake Washington Ship Canal	11/29/22 9:59 PM	11/29/22 10:31 PM	0.53	492,107	0.96	12.35	
014	Montlake Overflow	Lake Washington Ship Canal	12/24/22 9:05 AM	12/26/22 3:13 AM	42.13	13,654,837	0.6	58.75	
014	Montlake Overflow	Lake Washington Ship Canal	12/30/22 12:09 AM	12/30/22 1:11 AM	1.03	730,573	0.46	14.78	
015	University Regulator	Lake Washington Ship Canal	1/2/22 7:26 PM	1/3/22 2:53 AM	7.45	31,996,803	2.25	16.17	
015	University Regulator	Lake Washington Ship Canal	1/6/22 6:48 PM	1/7/22 3:21 PM	20.55	38,009,358	3.01	122.85	
015	University Regulator	Lake Washington Ship Canal	1/11/22 2:51 AM	1/11/22 3:09 AM	0.30	276,265	0.51	18.8	
015	University Regulator	Lake Washington Ship Canal	2/27/22 11:31 PM	2/28/22 5:51 PM	18.33	15,597,421	2.04	49.5	
015	University Regulator	Lake Washington Ship Canal	4/4/22 2:38 AM	4/4/22 3:34 AM	0.93	1,680,807	0.69	9.77	
015	University Regulator	Lake Washington Ship Canal	6/5/22 8:40 AM	6/5/22 9:12 AM	0.53	2,623,250	0.99	13.65	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
015	University Regulator	Lake Washington Ship Canal	11/6/22 8:00 AM	11/6/22 8:38 AM	0.63	1,249,830	1.14	6.60	
015	University Regulator	Lake Washington Ship Canal	11/22/22 12:51 PM	11/22/22 1:17 PM	0.43	466,345	0.95	7.40	
015	University Regulator	Lake Washington Ship Canal	12/24/22 9:24 AM	12/27/22 10:16 AM	72.87	25,830,280	3.78	89.73	
027a	Denny Way Regulator	Elliott Bay	1/7/22 12:07 PM	1/7/22 12:24 PM	0.28	23,794	2.98	120.95	
027a	Denny Way Regulator	Elliott Bay	12/24/22 9:57 AM	12/24/22 10:55 AM	0.97	317,283	1.44	18.53	
028	King Street Regulator	Elliott Bay	6/5/22 8:26 AM	6/5/22 8:42 AM	0.27	138,158	1.08	64.37	
028	King Street Regulator	Elliott Bay	6/9/22 3:43 PM	6/9/22 7:20 PM	3.62	810,396	0.79	11.12	
028	King Street Regulator	Elliott Bay	10/31/22 12:26 AM	10/31/22 5:05 AM	4.65	1,144,852	0.76	4.95	
028	King Street Regulator	Elliott Bay	11/6/22 5:35 AM	11/6/22 10:34 AM	4.98	1,325,348	0.78	6.88	
028	King Street Regulator	Elliott Bay	11/7/22 4:13 PM	11/7/22 4:21 PM	0.13	21,006	1.19	39.08	
028	King Street Regulator	Elliott Bay	12/24/22 9:41 AM	12/24/22 10:57 AM	1.27	591,254	1.32	18.08	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/6/22 5:29 AM	11/6/22 10:56 AM	5.45	2,644,755	0.78	6.88	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/22/22 11:17 AM	11/22/22 5:23 PM	6.10	4,792,466	1.01	8.48	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/25/22 10:04 AM	11/25/22 11:45 AM	1.68	8,195,752	0.56	4.15	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/29/22 8:22 PM	11/30/22 11:45 AM	15.38	7,690,909	1.22	13.08	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/9/22 9:21 PM	12/10/22 11:45 AM	14.40	2,691,143	1.12	55.43	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/20/22 10:01 AM	12/20/22 11:45 AM	1.73	260,043	0.5	40.28	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/24/22 7:58 AM	12/27/22 11:45 AM	75.78	40,604,141	3.63	99.27	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/30/22 12:17 AM	12/30/22 11:45 AM	11.47	3,563,691	0.26	23.53	
030	Lander St. Regulator	Duwamish River – East Waterway	1/2/22 7:54 PM	1/4/22 9:42 AM	37.80	119,634,282	2.38	42.33	
030	Lander St. Regulator	Duwamish River – East Waterway	1/6/22 1:13 AM	1/7/22 10:52 PM	45.65	166,267,926	5.01	121.55	
030	Lander St. Regulator	Duwamish River – East Waterway	1/11/22 2:24 AM	1/12/22 1:58 AM	23.57	18,175,973	1.31	40.68	
030	Lander St. Regulator	Duwamish River – East Waterway	1/13/22 8:01 AM	1/13/22 8:49 AM	0.80	711,220	1.59	71.95	
030	Lander St. Regulator	Duwamish River – East Waterway	2/26/22 10:27 PM	3/1/22 4:14 PM	65.78	72,359,295	3.43	64.18	
030	Lander St. Regulator	Duwamish River – East Waterway	3/14/22 7:46 PM	3/14/22 8:08 PM	0.37	44,413	0.41	50.37	
030	Lander St. Regulator	Duwamish River – East Waterway	4/4/22 1:04 AM	4/4/22 7:02 AM	5.97	8,616,290	0.81	12.9	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
030	Lander St. Regulator	Duwamish River – East Waterway	5/12/22 3:20 PM	5/12/22 3:31 PM	0.18	6,408	0.16	9.27	
030	Lander St. Regulator	Duwamish River – East Waterway	5/15/22 2:46 PM	5/15/22 6:59 PM	4.22	4,065,739	0.17	7.83	
030	Lander St. Regulator	Duwamish River – East Waterway	6/5/22 9:23 AM	6/5/22 9:56 AM	0.55	338,888	1.15	62.95	
030	Lander St. Regulator	Duwamish River – East Waterway	6/9/22 3:36 PM	6/9/22 7:20 PM	3.73	4,576,257	0.83	11.43	
030	Lander St. Regulator	Duwamish River – East Waterway	10/31/22 12:45 AM	10/31/22 3:34 AM	2.82	5,835,302	0.93	5.85	
030	Lander St. Regulator	Duwamish River – East Waterway	11/6/22 5:44 AM	11/6/22 9:11 AM	3.45	7,437,905	1.01	6.43	
030	Lander St. Regulator	Duwamish River – East Waterway	11/22/22 11:33 AM	11/22/22 4:51 PM	5.30	20,366,763	1.06	8.55	
030	Lander St. Regulator	Duwamish River – East Waterway	11/25/22 10:11 AM	11/25/22 5:39 PM	7.47	12,816,804	0.65	4.12	
030	Lander St. Regulator	Duwamish River – East Waterway	11/29/22 8:16 PM	11/30/22 1:23 PM	17.12	27,784,860	1.75	24.18	
030	Lander St. Regulator	Duwamish River – East Waterway	12/9/22 8:22 PM	12/10/22 6:12 PM	21.83	18,522,615	0.48	81.32	
030	Lander St. Regulator	Duwamish River – East Waterway	12/20/22 9:54 AM	12/20/22 12:39 PM	2.75	303,919	0.38	38.97	
030	Lander St. Regulator	Duwamish River – East Waterway	12/24/22 7:10 AM	12/27/22 9:31 PM	86.35	220,318,476	4.29	100.6	
030	Lander St. Regulator	Duwamish River – East Waterway	12/30/22 12:31 AM	12/30/22 11:51 AM	11.33	12,626,746	0.15	25.77	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/2/2022 11:24 AM	1/3/2022 11:46 AM	24.37	15,148,114	2.05	24.37	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/6/22 5:38 PM	1/7/22 2:13 PM	20.58	10,350,834	5.00	121.55	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/31/22 12:19 AM	10/31/22 2:03 AM	1.73	218,256	0.85	4.83	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/22/22 12:25 PM	11/22/22 1:23 PM	0.97	345,409	0.91	6.62	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	12/24/22 9:25 AM	12/26/22 8:47 AM	47.37	6,465,995	2.16	64.85	
032	Hanford #2 Regulator	Duwamish River – East Waterway	1/2/22 7:57 PM	1/4/22 10:49 AM	38.87	71,998,975	2.37	42.33	
032	Hanford #2 Regulator	Duwamish River – East Waterway	1/6/22 1:14 AM	1/8/22 1:35 AM	48.35	139,791,225	5.00	121.55	
032	Hanford #2 Regulator	Duwamish River – East Waterway	1/11/22 2:24 AM	1/13/22 9:46 AM	55.37	69,145,979	1.59	71.95	
032	Hanford #2 Regulator	Duwamish River – East Waterway	2/27/22 8:16 PM	3/1/22 4:58 PM	44.70	49,302,939	3.43	64.18	
032	Hanford #2 Regulator	Duwamish River – East Waterway	4/4/22 1:08 AM	4/4/22 5:08 AM	4.00	7,495,625	0.81	12.9	
032	Hanford #2 Regulator	Duwamish River – East Waterway	5/12/22 3:17 PM	5/12/22 4:30 PM	1.22	616,692	0.18	9.52	
032	Hanford #2 Regulator	Duwamish River – East Waterway	5/15/22 2:51 PM	5/15/22 6:54 PM	4.05	1,229,109	0.17	7.83	
032	Hanford #2 Regulator	Duwamish River – East Waterway	6/5/22 4:13 AM	6/5/22 10:49 AM	6.60	1,244,585	1.15	62.95	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
032	Hanford #2 Regulator	Duwamish River – East Waterway	6/9/22 3:40 PM	6/9/22 10:40 PM	7.00	7,003,869	0.94	14.18	
032	Hanford #2 Regulator	Duwamish River – East Waterway	10/31/22 12:52 AM	10/31/22 3:48 AM	2.93	5,845,664	0.93	5.85	
032	Hanford #2 Regulator	Duwamish River – East Waterway	11/6/22 5:48 AM	11/6/22 9:22 AM	3.57	7,172,522	1.02	6.43	
032	Hanford #2 Regulator	Duwamish River – East Waterway	11/22/22 11:39 AM	11/22/22 5:14 PM	5.58	5,072,503	1.06	8.55	
032	Hanford #2 Regulator	Duwamish River – East Waterway	11/25/22 10:15 AM	11/25/22 11:45 AM	1.50	3,148,473	0.65	4.12	
032	Hanford #2 Regulator	Duwamish River – East Waterway	11/29/22 8:22 PM	11/30/22 2:05 PM	17.72	19,804,019	1.79	25.43	
032	Hanford #2 Regulator	Duwamish River – East Waterway	12/9/22 8:29 PM	12/10/22 7:01 PM	22.53	4,296,659	0.58	58.5	
032	Hanford #2 Regulator	Duwamish River – East Waterway	12/20/22 9:58 AM	12/20/22 11:03 AM	1.08	932,614	0.55	22.25	
032	Hanford #2 Regulator	Duwamish River – East Waterway	12/24/22 7:57 AM	12/27/22 10:36 PM	86.65	53,246,420	4.29	100.6	
032	Hanford #2 Regulator	Duwamish River – East Waterway	12/30/22 12:36 AM	12/30/22 1:59 PM	13.38	4,868,881	0.72	20.2	
035	West Duwamish	Duwamish River	1/2/22 10:43 PM	1/3/22 12:36 AM	1.88	148,364	2.66	13.13	
035	West Duwamish	Duwamish River	12/24/22 10:04 AM	12/24/22 11:11 AM	1.12	75,472	1.55	19.58	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/2/22 7:56 PM	1/3/22 5:25 PM	21.48	2,150,277	2.23	26.57	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/6/22 2:34 AM	1/7/22 3:04 PM	36.50	4,679,896	5.01	121.55	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/11/22 7:42 AM	1/11/22 10:04 PM	14.37	133,172	1.24	37.15	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/27/22 9:33 PM	3/1/22 1:38 AM	28.08	3,105,574	3.38	55.12	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	10/31/22 1:00 AM	10/31/22 4:37 AM	3.62	431,711	0.93	7.12	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/6/22 7:09 AM	11/6/22 9:50 AM	2.68	321,657	1.02	6.43	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/22/22 12:17 PM	11/22/22 4:20 PM	4.05	514,854	1.06	8.55	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/29/22 9:56 PM	11/30/22 6:39 AM	8.72	1,206,519	1.74	15.87	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/24/22 9:26 AM	12/27/22 11:52 AM	74.43	3,858,135	4.12	91.03	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/30/22 12:40 AM	12/30/22 2:19 AM	1.65	181,764	0.58	16.18	
038	Terminal 115 Overflow	Duwamish River	1/2/22 10:35 PM	1/3/22 2:05 AM	3.50	297,917	1.59	37.17	
038	Terminal 115 Overflow	Duwamish River	12/24/22 10:20 AM	12/24/22 11:40 AM	1.33	57,382	1.63	16.05	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	1/6/22 1:13 AM	1/6/22 4:02 PM	14.82	2,175,027	3.65	100.37	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	1/11/22 2:12 AM	1/11/22 11:28 AM	9.27	1,830,550	1.16	27.38	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	2/27/22 8:44 PM	2/28/22 11:38 AM	14.90	11,407,533	2.96	43.83	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	5/12/22 2:15 PM	5/12/22 2:48 PM	0.55	20,206	0.43	12.02	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	10/31/22 12:51 AM	10/31/22 3:21 AM	2.50	1,259,438	0.94	6.03	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	11/6/22 7:51 AM	11/6/22 8:27 AM	0.60	37,441	1.02	6.53	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	11/22/22 12:42 PM	11/22/22 1:34 PM	0.87	135,453	0.98	6.28	
039	Michigan Regulator (AKA S Michigan Regulator)	Duwamish River	12/24/22 11:02 AM	12/24/22 11:03 AM	0.00	24	1.54	15.38	
040	8th Ave. South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River	1/2/22 11:50 PM	1/3/22 12:35 AM	0.75	52,083	1.51	35.60	
040	8th Ave. South Regulator (AKA W Marginal Way Pump Station)	Duwamish River	1/7/22 12:45 AM	1/7/22 2:17 AM	1.53	107,895	4.80	133.12	
040	8th Ave. South Regulator (AKA W Marginal Way Pump Station)	Duwamish River	2/28/22 1:54 PM	2/28/22 5:34 PM	3.67	453,755	3.53	49.83	
040	8th Ave. South Regulator (AKA W Marginal Way Pump Station)	Duwamish River	12/24/22 10:30 AM	12/24/22 12:34 PM	2.07	277,883	1.7	16.55	
040	8th Ave. South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River	12/27/22 9:42 AM	12/27/22 2:03 PM	4.35	1,936,981	4.11	89.48	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
041	Brandon Street Regulator	Duwamish River	1/2/22 10:14 PM	1/3/22 12:40 AM	2.43	2,173,426	1.76	13.23	
041	Brandon Street Regulator	Duwamish River	12/24/22 9:59 AM	12/24/22 11:08 AM	1.15	800,466	1.55	19.58	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	1/2/22 10:05 PM	1/3/22 2:46 AM	4.68	708,607	1.72	37.87	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	1/6/22 2:05 PM	1/7/22 12:55 PM	22.83	2,836,819	5.11	143.87	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	1/11/22 7:26 AM	1/11/22 8:25 AM	0.98	87,386	1.06	24.58	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	2/28/22 6:39 AM	2/28/22 10:28 PM	15.82	2,050,619	3.37	54.28	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	10/31/22 1:44 AM	10/31/22 2:35 AM	0.85	53,920	0.94	6.08	
042	West Michigan (AKA SW Michigan St. Regulator)	Duwamish River	12/24/22 10:12 AM	12/24/22 12:27 PM	2.25	304,824	1.27	9.62	
044a	Norfolk local drainage	Duwamish River	12/24/22 8:26 AM	12/24/22 8:42 AM	0.27	105,848	1.83	21.75	
048a	North Beach Pump Station (wet well)	Puget Sound	1/2/22 8:12 PM	1/3/22 11:55 AM	15.71	1,312,712	3.01	24.36	
048a	North Beach Pump Station (wet well)	Puget Sound	1/7/22 12:01 AM	1/7/22 2:08 PM	14.12	421,014	6.09	122.45	
048a	North Beach Pump Station (wet well)	Puget Sound	12/24/22 9:49 AM	12/24/22 2:38 PM	4.82	455,959	1.52	21.60	
048a	North Beach Pump Station (wet well)	Puget Sound	12/26/22 12:01 AM	12/27/22 10:01 PM	46.01	1,352,612	4.88	99.93	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or eCSO
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/2/22 10:21 PM	1/2/22 10:45 PM	0.40	89,290	1.99	15.14	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/24/22 10:10 AM	12/24/22 10:20 AM	0.17	225	1.37	19.07	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/27/22 7:15 AM	12/27/22 7:45 AM	0.50	54,496	1.45	88.58	
049	30th Avenue NE Pump Station	Lake Washington	12/24/22 9:50 AM	12/24/22 12:40 PM	2.83	2,802	1.44	19.53	
049	30th Avenue NE Pump Station	Lake Washington	12/26/22 2:15 AM	12/26/22 2:25 AM	0.17	14	2.5	57.75	
052	53rd Avenue SW Pump Station	Puget Sound	2/28/22 6:40 AM	2/28/22 9:31 AM	2.85	76,026	2.56	41.65	
054	63rd Avenue SW Pump Station	Puget Sound	1/2/22 9:48 PM	1/3/22 12:00 AM	2.20	38,695,188	2.02	16.72	
054	63rd Avenue SW Pump Station	Puget Sound	1/6/22 5:45 PM	1/7/22 3:46 AM	10.02	49,854,845	2.97	111.6	
054	63rd Avenue SW Pump Station	Puget Sound	2/28/22 6:07 AM	2/28/22 5:44 PM	11.62	28,226,790	3.68	50.12	
057	Barton Street Pump Station	Puget Sound	1/2/22 10:14 PM	1/2/22 10:30 PM	0.27	15,462	0.16	25.28	
057	Barton Street Pump Station	Puget Sound	1/7/22 1:00 AM	1/7/22 1:11 AM	0.18	4,110	3.45	124.7	
Total Volume						**1,664 MG**			

Appendix B
Treated CSO Events
January–December 2022

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
051b	Alki CSO Treatment Facility	Puget Sound	1/2/22 10:08 PM	1/3/22 5:06 PM	18.25	20.17	2.50	89.47	
051b	Alki CSO Treatment Facility	Puget Sound	1/6/22 5:17 PM	1/7/22 5:08 PM	22.62	31.60	3.33	53.17	
051b	Alki CSO Treatment Facility	Puget Sound	1/11/22 7:55 PM	1/12/22 2:09 AM	4.77	2.35	1.58	42.41	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	2/28/22 1:59 AM	2/28/22 11:54 PM	21.77	27.52	3.99	55.55	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/24/22 10:50 AM	12/24/22 5:53 PM	6.57	7.04	3.17	63.53	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/26/22 8:04 AM	12/27/22 5:08 PM	5.68	4.51	1.13	27.50	
046b	Carkeek CSO Treatment Facility	Puget Sound	1/2/22 7:57 PM	1/4/22 10:23 AM	36.23	11.75	2.82	72.68	
046b	Carkeek CSO Treatment Facility	Puget Sound	1/6/22 6:57 PM	1/8/22 2:34 PM	39.20	12.18	2.55	54.58	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
046b	Carkeek CSO Treatment Facility	Puget Sound	2/28/22 7:11 AM	2/28/22 10:10 PM	14.80	2.23	3.18	54.03	
046b	Carkeek CSO Treatment Facility	Puget Sound	12/24/22 9:37 AM	12/24/22 2:52 PM	5.30	1.30	1.75	39.77	
046b	Carkeek CSO Treatment Facility	Puget Sound	12/25/22 11:25 PM	12/28/22 4:07 AM	39.85	8.00	39.90	61.55	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/2/22 8:26 PM	1/3/22 1:00 PM	13.90	46.11	2.24	67.60	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/5/22 4:52 AM	1/7/22 4:28 PM	24.80	98.16	2.48	54.53	
027b	Elliott West CSO Treatment Facility	Puget Sound	2/27/22 10:53 PM	2/28/22 9:45 PM	22.87	49.47	2.92	53.65	
027b	Elliott West CSO Treatment Facility	Puget Sound	4/4/22 2:56 AM	4/4/21 5:16 AM	2.33	3.58	0.78	9.12	
027b	Elliott West CSO Treatment Facility	Puget Sound	6/5/22 10:55 AM	6/5/22 11:24 AM	0.48	0.23	1.34	66.00	
027b	Elliott West CSO Treatment Facility	Puget Sound	6/9/22 4:49 PM	6/9/22 9:53 PM	5.05	12.19	0.94	13.42	
027b	Elliott West CSO Treatment Facility	Puget Sound	10/31/22 10:55 AM	10/31/22 11:24 AM	2.20	1.60	0.77	6.75	
027b	Elliott West CSO Treatment Facility	Puget Sound	11/6/22 8:09 AM	11/6/22 9:59 AM	1.83	2.55	1.4	8.70	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
027b	Elliott West CSO Treatment Facility	Puget Sound	11/22/22 12:49 PM	11/22/22 5:21 PM	4.50	5.86	0.97	8.52	
027b	Elliott West CSO Treatment Facility	Puget Sound	11/29/22 10:55 PM	11/30/22 6:16 AM	7.32	8.39	1.59	14.68	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/24/22 8:53 AM	12/24/22 7:31 PM	10.60	34.32	1.66	38.60	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/25/22 11:11 PM	12/27/22 9:49 PM	18.50	28.70	2.36	62.70	
044b	MLK/Henderson CSO Treatment Facility	Duwamish River	1/3/22 2:58 AM	1/3/22 2:26 PM	11.40	1.84	1.86	25.70	
044b	MLK/Henderson CSO Treatment Facility	Duwamish River	1/6/22 8:55 PM	1/7/22 1:16 PM	16.40	8.13	4.25	121.13	
044b	MLK/Henderson CSO Treatment Facility	Duwamish River	2/28/22 10:22 AM	3/1/22 5:51 AM	19.48	9.73	3.91	58.50	
1	West Point[1]	Puget Sound	1/2/22 7:13 PM	1/3/22 3:30 PM	19.50	42.27	0.99	30.85	
1	West Point[1]	Puget Sound	1/6/22 1:52 AM	1/7/22 7:49 PM	30.98	31.19	2.32	127.25	
1	West Point[1]	Puget Sound	1/11/22 2:29 AM	1/11/22 10:02 PM	6.32	3.70	0.96	36.87	
1	West Point[1]	Puget Sound	2/27/22 7:59 PM	2/28/22 10:41 PM	26.27	53.50	3.00	54.03	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
1	West Point[1]	Puget Sound	4/4/22 12:46 AM	4/4/22 5:44 AM	4.97	8.86	0.78	8.38	
1	West Point[1]	Puget Sound	5/12/22 3:30 PM	5/12/22 5:02 PM	1.53	0.85	0.37	3.82	
1	West Point[1]	Puget Sound	5/29/22 4:01 PM	5/29/22 4:33 PM	3.02	3.61	0.86	24.2	
1	West Point[1]	Puget Sound	6/5/22 3:56 AM	6/5/22 12:49 PM	5.78	5.93	0.78	12.8	
1	West Point[2]	Puget Sound	6/7/22 11:28 PM	6/8/22 12:20 AM	1.30	1.54	0.06	No rain registered during this time	
1	West Point[1]	Puget Sound	6/9/22 3:04 PM	6/10/22 12:20 AM	9.27	16.60	1.00	15.17	
1	West Point[1]	Puget Sound	10/31/22 12:41 AM	10/31/22 4:11 AM	3.50	5.36	0.86	6.52	
1	West Point[1]	Puget Sound	11/6/22 5:55 AM	11/6/22 10:40 AM	4.73	7.03	0.88	6.8	
1	West Point[1]	Puget Sound	11/22/22 12:05 PM	11/22/22 4:28 PM	4.37	5.34	0.89	2.7	
1	West Point[1]	Puget Sound	11/25/22 10:52 AM	11/25/22 4:06 PM	3.13	1.09	0.61	8.43	

Outfall # (DSN)	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
1	West Point[1]	Puget Sound	11/29/22 9:01 PM	11/30/22 6:12 AM	7.45	7.26	1.61	16.32	
1	West Point[1]	Puget Sound	12/9/22 8:47 PM	12/10/22 1:23 AM	4.48	2.97	1.51	21.23	
1	West Point[1]	Puget Sound	12/24/22 9:13 AM	12/24/22 4:23 PM	7.13	6.78	1.26	22.52	
1	West Point[1,3]	Puget Sound	12/24/22 9:13 AM	12/27/22 11:36 PM	27.73	36.49	3.11	101.33	
1	West Point[1]	Puget Sound	12/30/22 12:18 AM	12/30/22 4:55 AM	4.60	8.87	0.85	28.48	
Total Volume						**263.74**			

Notes:

[1] Flow at West Point exceeded 300 MGD.

[2] Secondary diversion caused by power outage at West Point Treatment Plant.

[3] This event is part of a 3-day-long storm and CSO event.

Appendix C
Alki Wet Weather Treatment Station
Annual Report

January–December 2022

Executive Summary

This 2022 annual report summarizes the 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 National Pollutant Discharge Elimination System (NPDES) permit for the West Point Treatment Plant (WA-0029181).

The year 2022 was slightly wetter than normal, producing nine filling events and six discharge events at Alki WWTS. The nine discharge events occurred over 14 reporting days and five months. The Alki WWTS received a total of 108.8 million gallons (MG) and discharged 93.2 MG. A total of 41.24 inches (in.) of rain fell in 2022 as measured at the rain gauge at the Murray Ave. Pump Station. King County switched to the rain gauge in late 2019 to report Alki WWTS rainfall data. The annual rainfall for 2022 at SeaTac was 40.27 in.; the 20-year average of annual total rainfall at SeaTac is 40.06 in.

Table C-1 summarizes the performance of Alki WWTS in 2022. This station was compliant with all permit conditions except the annual total suspended solids (TSS) removal and the daily minimum pH on two occasions. The annual TSS removal for 2022 was 37.0 percent, which did not meet the annual 50 percent TSS removal limit. Effluent settleable solids (SS) averaged 0.1. milliliters/liter/hour (mL/L/hr), which met the annual permit limit of 0.3 ml/L/hr. The effluent total residual chlorine (TRC) averaged no greater than 87 µg/L on any discharge day. The effluent fecal coliform geomeans were no greater than 371 counts per 100 mL during any discharge month. The effluent pH exceeded the minimum on two discharge days in 2022. There was no permit exceedance for maximum pH greater than 9.0 throughout the reporting year.

Table C-1. Alki WWTS Permit Performance in 2022

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**6**	**29**
Discharge volume million gallons (MG)[a]	**93.2**	**108**
Annual average SS (mL/L/hr)	**0.1**	**0.3**
Annual average TSS removal – including all discharge events (%)	**37**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**2 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	**0 out of 10 discharge days**	**≤ 234 µg/L**

Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**0 out of 3 discharge months**	**400/ 100 mL**

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

Suspended and Settleable Solids

Total suspended solids (TSS) removal averaged 37 percent in 2022, which includes all discharge events. This did not meet the annual average TSS removal permit level of 50 percent. The annual event average SS was 0.07 mL/L/hr, and thus met the annual average NPDES permit level of 0.3 mL/L/hr.

Historically, complying with the annual 50 percent TSS removal limit at the Alki WWTS has been a challenge. Past operational changes were made to improve TSS removal with little success. These changes included changes in the filling operation of the sedimentation tanks, periodic cleaning of the effluent channel of accumulated solids and adding variable frequency drives (VFD) to raw sewage pumps at the 63rd Ave. Pump Station to smooth the influent pumping swings at Alki WWTS. A new project was started in 2021 to determine the solids mass balance and evaluate the use of lamella plates in the sedimentation tanks to improve the solids removal at Alki WWTS.

Fecal Coliform Bacteria

All three discharge months in 2022 met the fecal coliform monthly geomean limit of 400 counts per 100 mL; the results were 351 counts per 100 mL in January, 7 counts per 100 mL in February, and 371 counts per 100 mL in December 2022. All fecal coliform samples collected during these months were valid.

Total Residual Chlorine

All 10 discharge days at the Alki WWTS met the daily average TRC permit limit of 234 µg/L. The 2022 annual effluent TRC average was 15 µg/L, with the maximum daily average of 87 µg/L occurring during the February 27, 2022, discharge event.

Instantaneous Minimum and Maximum Effluent pH

There were two discharge days that resulted in the discharge effluent exceeding the minimum pH permit of 6.0 at Alki WWTS. The February 27 to 28, 2022, event had a minimum pH of 5.0 on the first day of the two-day discharge event and the second occurred on December 24, 2022, with a minimum pH of 3.6. Both permit violations occurred at the beginning of the discharge events, and the pH steadily increased and stabilized to a pH above 6.0 after only a few minutes. This would suggest that the low pH was not representative of the effluent. Data indicate that there was septic water in the sample line prior to the events, and the increase in pH was due to fresh effluent entering the sample intake line. Steps are taken to increase the flushing water through this line before and after events.

Operation and Maintenance

Major upgrades to the Alki WWTS were completed in recent years; staff evaluated and adjusted, as needed, in 2022. The following are highlights of operations and maintenance (O&M) activities during 2022:

- Conducted annual CSO refresher training for the operators.

- Quarterly/monthly testing of hypochlorite and bisulfite solution strength; set point changes made to chemical feed pumps based on solution strength; shipments of full-strength solutions ordered as necessary.
- 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.
- Periodic cleaning of the effluent channel of accumulated solids and debris to improve treatment including solids removal.
- Ongoing, routine preventive maintenance practice to exercise the chemical feed pumps on a monthly basis.
- Completed work on the final effluent sampling pump stilling well to improve effluent flow through the stilling well and to prevent low pH exceedances.
- Continue preventive maintenance by Off-Site Instrumentation and Electrical staff of online chlorine and pH analyzers, including weekly calibration and replacement of probes and other instrumentation components, as necessary.

Alki Improvement Solids/TSS Removal Project

A project was started in early 2021 to evaluate if the abandoned digester tanks could be used as solids holding tanks during discharge events. This project has included a structural inspection and evaluation of the digester tanks, and evaluation of potential treatment process changes to improve the solids removal at Alki. The preliminary findings indicate that the digester tanks are structurally sound for holding solids; however, additional modifications in pumping, piping, and odor control would be needed, requiring a substantial capital cost. As a follow-up to this project of converting the digesters into solids storage, further evaluations of treatment performance were also recommended. The recommendations included the installation of online solids monitoring and additional sampling to perform more robust solids mass balances, and the installation of lamella plates in the sedimentation tanks to increase the solids removal performance. The follow-up phase would be data analysis and recommendations, if any, for potential treatment process changes. These discussions are 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. WTD staff will continue to investigate issues and make any necessary adjustments in the O&M. In addition, WTD staff responding to Alki WWTS will:

- Continue with the evaluation and make necessary adjustments to the new hypochlorite feed system.
- Continue to evaluate the TSS removal performance and support the solids removal improvement project.
- Continue to evaluate and make necessary improvements to inline pH measurements to prevent low pH excursions from nonrepresentative sample flows.

Table C-2. Alki WWTS 2022 Annual Event Data Summary

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MG)	Alki Discharge Event Number	Alki Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% Removal	Alki Effl. Daily Settl Solids (ml/l/hr)	Alki Effl. Settl Solids Event Avg (ml/l/hr)	Alki Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
January	1/2/2022	1	16.8	1	15.3	5056	3210		<0.1	0.1	1300/45	23	6.6/7.0
	1/3/2022	1	5.0	1	4.9	0.0	0.0					2	6.7/7.0
	1/6/2022	2	24.4	2	22.9	8557	6624		<0.1		1300/40	5	6.5/7.0
	1/7/2022	2	8.9	2	8.7	3195	2043		<0.1	0.1	340	3	6.4/6.8
	1/11/2022	3	4.3	3	2.4	532	835		<0.1	0.1	4900/130	5	6.6/7.3
	Instant. Min/Max pH												6.4/7.3
	Event/Daily Max									**0.1**		**23**	
	Monthly Total/Avg/Geo Mean	**3**	**59.4**	**3**	**54.1**	**17,340**	**12,712**	**26.7%**			**351**		
February	2/27/2022	1	7.4	1	5.9	1,602	1,305		0.0		330/1	87	5.0/6.7
	2/28/2022	1	21.7	1	21.7	11,050	7,858		0.0	0.0	1	19	6.2/6.7
	Instant. Min/Max pH												5.0/6.7
	Event/Daily Max									**0.00**		**87**	
	Monthly Total/Avg/Geo Mean	**1**	**29.1**	**1**	**27.5**	**12,652**	**9,163**	**27.6%**			**7**		
March	No Inflow/No Disch.												

	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	0	0.0	0	0.0	-	-	-			ND		
April	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	0	0.0	0	0.0	-	-	-			ND		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	0	0.0	0	0.0	-	-	-			ND		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	0	0.0	0	0.0	-	-	-			ND		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	0	0.0	0	0.0	-	-	-			ND		
August	No Inflow/No Disch.												

	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
October	10/30/2022	1	0.56	ND	ND	472	13						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	**1**	**0.6**	**0**	**ND**	**472**	**13**	**97.3%**			**ND**		
November	11/22/2022	1	0.27	ND	ND	311	38						
	11/29/2022	2	2.07	ND	ND	639	38						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/Geo Mean	**2**	**2.34**	**0**	**0.0**	**950**	**76**	**91.9%**			**ND**		
December	12/24/2022	1	8.67	1	7.04	8,677	3,562		0.1	0.1	230/490	3	3.6/6.8
	12/25/2022	2	1.62	ND	ND	486	61.39		ND	ND	ND	ND	ND
	12/26/2022	2	2.83	2	1.79	1,015	822		0.1		130	3	6.4/6.9
	12/27/2022	2	4.21	2	2.72	2,388	1,283		0.1	0.1	1,300	3	6.9/7.8
	Instant. Min/Max pH												3.6/7.8
	Event/Daily Max									**0.10**		**3**	
	Monthly Total/Avg/Geo Mean	**2**	**17.3**	**2**	**11.6**	**12,566**	**5,729**	**54.4%**			**371**		

Total	**9**	**108.8**	**6**	**93.2**	**43,980**	**27,692**						
Inst. pH Min/Max												3.6/7.8
Max (GEM, SS, TRC)										**371**	**87**	
Annual Average						by mass:	**37%**		**0.07**	**243**	**15**	

Notes:
ND = No discharge.
Red = NPDES permit exceedance.
%NS = No sample collected.
^ED = End of discharge; fecal coliform samples were collected before next grab sample was required.

Appendix D
Carkeek Wet Weather Treatment Station
Annual Report

January–December 2022

Executive Summary

This 2022 report summarizes the performance of Carkeek Wet Weather Treatment Station (Carkeek WWTS). The Carkeek WWTS began to operate as a CSO treatment facility on November 1, 1994. The Carkeek WWTS operates under the National Pollutant Discharge Elimination System (NPDES) permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181.

The year 2022 was slightly wetter than normal for the region, producing eight filling events and five discharge events at Carkeek WWTS. The five discharge events occurred over 11 reporting days and three months. Carkeek WWTS received a total of 39.1 million gallons (MG) and discharged 35.5 MG. Rainfall at the Ballard Station rain gauge—the gauge used for Carkeek WWTS reporting—totaled 39.41 inches (in.) in 2022. By comparison, 2022 annual rainfall at SeaTac was 40.27 in.; the 20-year average of annual total rainfall at SeaTac is 40.06 in.

Table D-1 summarizes the performance of Carkeek WWTS in 2022. Carkeek WWTS did not comply with the fecal coliform monthly geomean, exceeding the limit of 400 counts/100 mL during one discharge month. Carkeek WWTS effluent exceeded the total residual chlorine (TRC) permit daily average limit of 490 µg/L five times. Of these five days, the daily TRC reached as high as 4,572 µg/L. Carkeek WWTS effluent pH exceeded the minimum pH 6.0 on one discharge day out of 11. The maximum permit limit of pH 9.0 was never exceeded on all discharge days.

Carkeek WWTS met its annual average settleable solids (SS) limit, with the average measuring 0.15 ml/L/hr; the NPDES permit limit is 0.3 ml/L/hr. Total suspended solids (TSS) removal averaged 50 percent, which did meet the annual 50 percent TSS removal limit. Carkeek WWTS had three disinfection failures in 2022. These occurred from January 6 to January 8, February 28, and December 24. The three events are further discussed below in the fecal coliform bacteria section.

Table D-1. Carkeek WWTS Permit Performance in 2022

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**5**	**10**
Discharge volume million gallons (MG)[a]	**35.5**	**46**
Annual average SS (mL/L/hr)	**0.15**	**0.3**
Annual average TSS removal – including all discharge events (%)	**50**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**1 out of 11 discharge days**	**≥ 6.0**

Instantaneous maximum effluent pH, frequency of discharge days with pH> 9.0	**0 out of 11 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >490 µg/L	**5 out of 11 discharge days**	**≤ 490 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**1 out of 3 discharge months**	**400/100 mL**

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

Suspended and Settleable Solids

Total suspended solids (TSS) removal averaged 50 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent. The annual settleable solids (SS) for the year averaged 0.15 ml/L/hr, meeting the NPDES permit limit annual average of 0.3 ml/L/hr.

Fecal Coliform Bacteria

Carkeek did not meet the fecal coliform monthly geomean permit limit of 400 counts per 100 mL one month out of the three discharge months in 2022. The annual average of the monthly geomeans was 711,029 counts/100 ml. The cause of high measured fecal coliform concentrations during the February discharges, the discharge month not meeting the monthly geomean limit, was the result of the loss of disinfection, as noted below. All fecal coliform samples collected during these months were valid.

There were three disinfection failures at Carkeek in 2022. The three events with disinfection failures occurred on January 6, February 28, and December 24. The January 6 and February 28 failures were results of disruption of the hypochlorite feed when the metering pumps failed to feed hypochlorite. The hypochlorite pump was operating but was not pumping, and staff were unable to get the pump to operate continuously before the event ended. In response to the disinfection failure, the hypochlorite pumps have been rebuilt, and two new spare pumps have been added to inventory. Staff have also placed a temporary backup system on-site, using a tote of hypochlorite and a rotameter to measure flow. The temporary system will serve as a backup disinfection system until the staff are able to verify the primary hypochlorite system's operation and performance.

The other disinfection failure occurred on December 24, 2022. The data/communication telemetry had failed and was unavailable to send real-time data from Carkeek during the December discharge events. The disinfection failure on December 24 was the result of the hypochlorite feed pumps not starting as required. The level bubbler sensor system for the pump station wet well failed; with erroneous level output, the hypochlorite feed pumps did not start when the wet well level start trigger was reached. The responding operator started the hypochlorite feed pumps manually. The 0- to 3-hour fecal coliform sample was not sampled due to the lack of real-time data/communication from the Carkeek WWTS, preventing the West Point Main Control staff from having the information to call up an operator in response to a pending treatment and discharge event. Once the operator did arrive at Carkeek, the 0- to 3-hour sampling frequency was past due. The operator responded to the bubbler system failure and the disinfection failure, and then collected two fecal coliform samples. The failed telemetry has been fixed, with the long-term resolution to replace the aging telecommunication equipment. The scheduled phase-in for installing new, updated telecommunication equipment is the second quarter of 2023.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2022 reporting period were 5.8 and 7.6, respectively, thereby not meeting the NPDES permit limits of a minimum pH of 6.0 while meeting the maximum pH of 9.0.

The only minimum pH violation occurred on December 25, 2022. The region experienced heavy rainfall for five days, which resulted in two discharge events spanning four days. During the December 25, 2022, event, the facility exceeded the minimum pH of 6.0. The instantaneous pH dropped below 6.0 to 5.8. The high hypochlorite dose, along with the low alkalinity flow from heavy rainfall on top of melting snow and ice, resulted in the daily instantaneous minimum pH of 5.84. The dechlorination reaction using sodium bisulfite solution (SBS) consumes alkalinity and is acidic, which can drive down the pH. There is a dechlorination improvement project to address the reliability of the dechlorination system at Carkeek WWTS. (See the project description below under the “Dechlorination Improvement Project” section.)

Total Residual Chlorine

Carkeek did not meet the daily maximum average TRC on five of 11 discharge days during 2022. The maximum daily average effluent TRC during the 2022 reporting year was 4572 µg/L, thereby not meeting the NPDES permit limit of 490 µg/L. Four out of the 11 discharge days with TRC permit violations occurred during the two discharge events in January. The fifth violation occurred during the December 24 event. January 2022 was an extremely wet month with a total of 7.38 in. of rainfall; most of the rainfall and melting snow (5.36 in.) occurred January 2 to January 7, 2022. The subsequent treatment and discharge events resulted in four days of TRC violations covering two discrete events. The effluent TRC was high because of dechlorination system issues. Sodium bisulfite (SBS) has a relatively high freezing temperature (43 °F) and, due to the extended cold weather period, the chemical system was unable to operate as designed. There were crystals in the chemical that prevented the pumps from delivering an adequate dose. In preparation for the next wet weather event, staff had to backflush the SBS lines to re-establish flow.

There is a project underway to improve the SBS storage and feed system. The project includes improved heated chemical storage, SBS recirculation within the storage tanks during non-event periods, and new peristaltic metering pumps. The purpose of this project is to address chemical feed and dechlorination issues to avoid violating the permitted TRC limit. Construction of the new SBS system is expected to start by spring of 2024.

Operations and Maintenance

The following are highlights of operations and maintenance (O&M) activities during 2022:

- Conducted annual CSO refresher training for operators in September 2022.
- Received shipments of both sodium hypochlorite and SBS treatment chemicals.
- Continued to conduct debriefings with O&M staff after each discharge event to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Periodic cleaning out of the sedimentation tanks and effluent channel of accumulated solids and debris to improve solids removal.
- Continued monthly testing of the treatment chemicals’ concentrations (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 monthly.
- Continue preventive maintenance by Off-Site Instrumentation and Electrical staff of online chlorine and pH analyzers, including weekly calibration and replacement of probes and other instrumentation components, as necessary.
- Carkeek Pump Station evaluation and adjustments of the variable frequency drive is ongoing.
- O&M support of the telemetry upgrade (third party telecommunication company).
- Instrumentation technician data retrieval from data logger for continuous data collection during instances of telemetry loss.

Dechlorination Improvement Project

In late 2019, a new capital project was initiated to improve the reliability of the dechlorination system at Carkeek WWTS. This project entails upgrading the storage of sodium bisulfite (SBS) chemical solution from a single 1000-gallon tank to two 500-gallon tanks, upgrading the HVAC system, new chemical feed pumps, and upgraded amperometric chlorine analyzers. The project will also locate the sampling and instrumentation equipment in a dedicated room, separated from SBS chemical storage, to provide a safer workspace for staff during monitoring and maintenance. The project team has set a potential start of construction for spring 2024, with potential commissioning by summer 2024.

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:

- 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.
- Installation of new updated telecommunication equipment in the second quarter of 2023.
- Continue monthly or quarterly testing of the treatment chemicals’ concentrations (sodium hypochlorite and SBS solutions) and make necessary changes to the feed programs or ordered fresh chemicals.
- Continue a preventive maintenance practice to exercise the chemical feed pumps’ monthly and weekly calibration and preventive maintenance of online instrumentation.
- Continue to monitor and evaluate the completed flow measurement improvements.
- Support the Dechlorination Improvement capital project to upgrade the SBS chemical storage and feed system.

Table D-2. Carkeek WWTS 2022 Annual Event Data Summary

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MG)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% Removal	Carkeek Effl. Daily Settl Solids (ml/l/hr)	Carkeek Effl. Settl Solids Event avg (ml/l/hr)	Carkeek Avg daily Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/ Max pH
January	2	1	7.50	1	6.97	3253	888		0.00		1/45/1	3547	6.5/7.4
	3	1	4.64	1	4.71	1508	1113		0.10		1	4572	6.6/7.0
	4	1	0.09	1	0.06	115	33		0.10	**0.1**		3388	6.6/7.5
	5	1	0.14	ND	ND	205	19		ND				
	6	1	6.16	2	5.53	975	891		0.10		1/1	454	6.3/7.6
	7	1	6.51	2	6.55	2226	1424		0.10		790	552	6.6/6.9
	8	1	0.09	2	0.09	54	12		0.00	**0.1**		6	6.8/7.0
	10	2	0.06	ND	ND				ND				
	11	2	0.05	ND	ND	16	1		ND				
	13	3	0.02	ND	ND	45	2		ND				
	Instant. Min/Max pH												**6.1/7.6**
	Event/Daily Max									**0.07**		**4572**	
	Monthly Total/Avg/GeoMean	**3**	**25.24**	**2**	**23.92**	**8,399**	**4,383**	**47.8%**			**4.5**		
February	27	1	0.31	ND	ND	643	62				1300000		
	28	1	2.40	1	2.23	280	279		0.0	0.0	3500000	32	6.2/7.4
	Instant. Min/Max pH												**6.2/7.4**
	Event/Daily Max									**0.00**		**32**	

	Monthly Total/Avg/GeoMean	1	2.70	1	2.23	923	341	63.0%			2133073		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.00	ND	0.00	-	-	-			ND		
April	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.00	ND	0.00	-	-	-			ND		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.00	ND	0.00	-	-	-			ND		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.00	ND	0.00	-	-	-			ND		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	

	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
October	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
November	25	1	0.04	ND		53	5.65						
	29	2	0.91	ND		206	12.35						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.96**	**0**	**0.00**	**259**	**18**	**93.0%**			**ND**		
December	24	1	1.67	1	1.30	988	598		0.50	0.50	NS/124 500	2280	
	25	2	1.34	2	0.96	123	134		0.20		1/1	264	
	26	2	1.71	2	1.83	314	258		0.10		1	267	

	27	2	5.45	2	5.21	2454	1011		0.10	0.13	1	234	
	Instant. Min/Max pH												ND
	Event/Daily Max									0.5		2280	
	Monthly Total/Avg/GeoMean	2	10.17	2	9.30	3879	2000	48.4%			10		
Total		**8**	**39.07**	**5**	**35.45**	**13,459**	**6,743**						
Inst. pH Min/Max													**6.1/8.1**
Max (GEM, SS, TRC)											**2133073**		
Annual Average								**50%**		**0.15**	**711029**	**1,418**	

Notes:
ND = No discharge.
Red = NPDES permit exceedance.
%NS = No sample collected.
^ED = End of discharge; fecal coliform samples were collected, discharge ended before next grab sample was required.

Appendix E
Elliott West Wet Weather Treatment Station
Annual Report

January–December 2022

Executive Summary

This 2022 annual report summarizes the performance of the Elliott West Wet Weather Treatment Station (Elliott West 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. The current permit went into effect on February 1, 2015, was due to expire January 1, 2020, and was administratively extended. The permit issued in 2015 has been followed while King County awaits issuance of the new permit.

The year 2022 was slightly drier than what was reported at SeaTac International Airport, resulting in 36 inflow events and 12 discharge events at Elliott West WWTS. The 12 discharge events occurred over 18 reporting days and seven reporting months. Elliott West WWTS influent totaled 474.3 million gallons (MG) and 291.0 MG were discharged in 2022. Total rainfall in 2022 was 37.07 inches (in.) as measured at the Denny Way rain gauge (3165 Alaskan Way in Seattle). The annual total at Denny Way is considerably lower than the 2022 annual rainfall total of 40.27 in. at SeaTac. The 20-year average of annual rainfall at SeaTac International Airport is 40.06 in.

Table E-1 summarizes the performance of Elliott West WWTS in 2022. Elliott West WWTS did not comply with 26 out of a possible 63 permit conditions in 2022. Elliott West WWTS did not meet the permit limits for annual total suspended solids (TSS) removal of 50 percent. Elliott West WWTS did comply with the instantaneous effluent maximum pH of 9.0, but it did not meet the minimum pH of 6.0. Elliott West WWTS had permit violations for fecal coliform monthly geomean and maximum daily average total residual chlorine (TRC) of 109 µg/L. TSS removal averaged 39 percent over the year, which accounts for all inflow and discharge events.

Elliott West WWTS did not meet the fecal coliform monthly geomean permit limit of 400 counts per 100 mL during one out of the seven discharge months. The station did not comply with the annual average settleable solids (SS) limit of 0.3 milliliters/liter/hour (mL/L/hr.); effluent SS averaged 1.9 mL/L/hr in 2022. Daily average total residual chlorine (TRC) exceeded the permitted level of 109 µg/L on 11 of 18 discharge days; it reached as high as 4303 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on 12 of the 18 discharge days; it reached as low as pH 3.5 during an event.

All required samples were collected, and all required measurements were completed in 2022.

Table E-1. Elliott West WWTS Permit Performance in 2022

Parameter	Performance	Permit Conditions
Discharge events (number)	**12**	**NA**
Discharge volume million gallons (MG)	**291.0**	**NA**
Annual average SS (mL/L/hr)	**1.9**	**0.3**
Annual average TSS removal – including all discharge events (%)	**39**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**12 out of 18 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 >109 µg/L	**11 out of 18 discharge days**	**109 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**1 out of 7 discharge months**	**400/100 mL**

Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

In 2022, Elliott West WWTS did not meet the permit annual total suspended solids (TSS) removal limit of 50 percent, with an average of 39 percent. Elliott West WWTS did not meet the permit annual settleable solids (SS) average limit of 0.3 ml/L/hr. The annual SS concentration for 2022 averaged 1.89 mL/L/hr, with a maximum event SS value of 8.8 mL/L/hr on January 5, 2022. January and February had the lowest TSS removal for the year at 8 percent and 5 percent monthly TSS removal, respectively. Both months were very wet from rain and snow melt. Solids removal efficiency can be impacted by highly diluted inflows as is the case for high precipitation storm events.

With the ongoing challenges of meeting the NPDES permit limits at Elliott West WWTS, King County started a project to evaluate alternative CSO treatment for Elliott West WWTS to improve compliance. Until a new treatment facility is in operation, there are interim upgrades planned to start this next dry season. These interim improvements include upgrading the chlorination and dechlorination system by installing new hypochlorite and bisulfite feed pumps along with improved feed controls, and improvements to the compliance sampling system. The long-term plan is to design and build a treatment facility at the current Elliott West WWTS location.

Fecal Coliform Bacteria

In 2022, Elliott West WWTS did not meet the fecal coliform NPDES permit limit of 400 counts per 100-mL monthly geomean during one out of the seven discharge months. The maximum monthly geomean for fecal coliform bacteria was calculated as 4,469 counts per 100 mL and occurred in the month of June. The annual average of the monthly geomeans was 686 counts per 100 mL. The single event that had the high fecal coliform count and resulted in geomean greater than the permit limit occurred on June 5, 2022. That event had a disinfection failure as a result of an improperly set hypochlorite valve. The hypochlorite recirculation valve is open during the feed pump checks to allow the hypochlorite to recirculate back to the storage tanks.

This valve is normally closed after the routine pump checks. As a response to this incident, the operators had additional refresher training; additional signage and valve labels were also instituted to prevent reoccurrence.

There was an additional disinfection failure at Elliott West WWTS on January 6 to January 7, 2022, as a result of the station running out of sodium bisulfite (SBS). This activated an interlock, which prevents sodium hypochlorite dosing if dechlorination is not available. The prolonged storm event caused delays in receiving SBS treatment chemical from the vendor. Additional actions will be taken to improve fecal coliform inactivation during treatment and discharge events. The hypochlorite dosing set point has been increased in response to high fecal coliform values during past events, and further increases in the hypochlorite dose set point may be applied during future events. To date, this appears to have helped as fecal coliforms values have improved. However, the increased hypochlorite dose requires additional diligence to ensure compliance with the effluent chlorine and pH limits. 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 ongoing Elliott West WWTS assessment and improvement project by King County.

Total Residual Chlorine

During 2022, there were 11 out of 18 discharge days when the effluent daily average TRC exceeded the NPDES permit level of 109 µg/L. (Refer to Table E-2 for the discharge events that exceeded the TRC limits.) The annual average of all daily TRC values was 869 µg/L. The maximum daily average TRC of 4354 µg/L occurred on February 28, 2022. This discharge event spanned two days, February 27 to 28, and exceptionally heavy rain contributed to the overflows that occurred on those days. During this storm event, Elliott West WWTS exceeded its daily TRC permit limit of 109 µg/L, averaging 3801 µg/L on February 27 and 4354 µg/L on February 28. A high TRC is typically due to inadequate sodium bisulfite (SBS), the dechlorination chemical dose. During this event, the SBS dose was adequate. A follow-up investigation as to why such high TRC concentrations occurred found leaks in the suction side of final effluent (FE) sample line. This leak may cause short-circuiting of the FE sample to the chlorine analyzer. The repairs are scheduled for the 2023 dry season because these repairs require dry conditions to allow safe entry into the Elliott West WWTS effluent vault and pipeline along with the need for dry conditions to allow for proper cure of the sealant and glue.

The Elliott West WWTS improvement project will include evaluating the SBS metering pumps' capacities and level of turn-down. Additional past actions include feeding a diluted SBS solution to aid in dispersion, increased C2 water capacity for reliable SBS carrier water, the use of an in-pipe SBS diffuser (in place of flash mixers), and the use of the "semi-auto" mode for SBS feed control during times of questionable pre-dechlorination analyzer output. King County staff will continue to monitor and adjust the hypochlorite and SBS dosing and further investigate areas to improve the chemical feed control.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum effluent pH in 2022 exceeded the minimum permit limit of pH 6.0 on twelve out of 18 total discharge days. The instantaneous maximum pH limit of 9.0 was met for each of the discharge days in 2022.

The effluent pH reached as low as pH 3.5 on December 25, 2022; this was the lowest effluent pH of the year. The December 25 event was preceded by a different storm event in which the effluent pH dropped below 6.0. The December 24 to December 27 discharge events were the result of several inches of rain and melting snow across five days. The low alkalinity CSO flows,

along with potential for overdosing the acidic SBS during high discharge flows and high pre-dechlorinated TRC values, can cause the effluent pH to drop below 6.0; it only takes a short moment below pH 6.0 to have a permit exceedance. Realizing these challenges, staff continue to fine-tune the SBS feed control program and optimize hypochlorite feed to reduce the SBS feed. Part of the challenge is that the inflow can drop so low in alkalinity (e.g., as low as 12 to 40 milligrams per liter [mg/L] as $CaCO_3$). By comparison, the influent alkalinity at West Point Treatment Plant (West Point) tends to be near 200 to 225 mg/L $CaCO_3$ on dry weather days. Some of the projects and actions to address dechlorination and TRC exceedances, as described in the previous section on final effluent TRC permit performance, will also benefit in meeting the minimum pH permit limits of the effluents.

Operations and Maintenance

The following are highlights of operations and maintenance (O&M) activities at Elliot West WWTS during 2022:

- Conducted annual CSO refresher training for the operators in September 2022.
- Provided remote monitoring support team in anticipation of a treatment and discharge event, and during the event.
- Received shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals as needed.
- Continued monthly testing of the treatment chemicals' concentrations (sodium hypochlorite and SBS solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- 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.
- Continued to monitor the effectiveness of the automated Mercer Tunnel flushing by taking additional samples from the return flows and running laboratory solids analyses on those samples.
- Continued to run the dewatering pumps during discharges to remove additional solids, which takes advantage of the turbulence and resuspension of solids in the wet well caused by the larger main pumps and increases the amount of solids in the return flows to West Point.
- 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 and cleaning and de-ragging within the dechlor and final effluent vaults/structures (equipment includes both pre-dechlor and final effluent sample pumps and sample line).
- Continued to exercise the hypochlorite chemical feed pumps on a monthly basis as a preventive maintenance measure.
- Made changes to the main pump control program, with the goal of minimizing large pump flow swings impacting treatment and impacts to upstream conveyance.
- Operated a post-inline SBS dilution system (installed in summer 2018) to dilute the 38 percent SBS to 20 percent solution. Evaluation of the diffuser continues.
- Implemented a "semi-auto" mode for SBS feed control, which would disable the input from the pre-dechlorination chlorine analyzer to the SBS feed program during times when the analyzer is not working properly.

Improvement Projects at Elliott West Wet Weather Treatment Station

King County has assembled a consultant team to plan and design a new treatment facility at Elliott West WWTS. The project will be built on the current Elliott West location. The preliminary analysis indicates that various high-rate treatment technologies would fit in the limited footprint of the site. There are ongoing planning and discussions on the various elements of this long-term project. Until the new facility is built and operating, the County is committed to addressing some of the current challenges in meeting permit compliance. These interim improvements include upgrades to the chlorination and dechlorination systems with new sets of feed pumps to better match the necessary feed ranges along with improved chemical feed controls. Interim improvements also include addressing the compliance and control point sampling reliability issues. Work on some of these interim improvements will start during the next dry season in 2023.

Near Future Operation

During the 18 years of operation, opportunities to operate and then to optimize Elliott West WWTS 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 late October 2017, it was discovered that the Elliott West WWTS CSO effluent drop structure drain gate (aka wet well drain gate) failed to close. This drain gate is normally closed during discharge events, but will automatically open after events to allow the facility to drain the treated flow in the effluent pipeline that was not discharged back into the facility where it can be transferred to West Point for treatment. The partially open gate allows recycling of some flow that has already been disinfected and dechlorinated, so proper dosing becomes more of a challenge. In September 2019, the drain gate was repaired; however, the contractor, during the repair work, discovered that the frame of the gate was seriously corroded and damaged and in need of repair or replacement. The repair and replacement of the gate, and the corroded frame, are scheduled for spring–summer 2023. Currently, the gate is operated manually after each event. The gate is opened once the wet well level is low enough for the hydraulic grade line to allow the remaining treated CSO in the final effluent pipe to drain back to the wet well where it is pumped back to West Point via the Elliott Bay Interceptor.

In addition, WTD staff will:

- Continue to investigate and, if possible, correct the cause(s) of the instantaneous minimum pH exceedances.
- Continue to implement the remote monitoring 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.
- Continue to sample and monitor copper and dissolved oxygen of Elliott West WWTS flow per the 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 was implemented in the summer of 2018 and fine-tuning will occur as necessary.
- Continue evaluation and fine-tuning of changes in the main pump control program.
- Continue discussions to periodically schedule a contractor to clean out the wet well as preventive maintenance.

Table E-2. Elliott West WWTS 2022 Annual Event Data Summary

Month	Day	`	EWCSO Inflow Volume (MG)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ EW + WP (lbs)	% Removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
January	2	1	45.9	1	44.4	36407	35932		1.0		45	1918	5.5/7.5
	3	1	7.9	1	1.7	2536	1709		2.4	1.7	1	2586	4.8/7.5
	4	1	2.7	ND	ND	5452	984						
	5	1	4.0	2	3.1	9144	8402		21.0		20/1	309	5.7/7.5
	6	1	59.7	2	56.5	37884	37321		2.9		70000	624	5.7/7.5
	7	1	45.2	2	38.6	39708	38462		2.4	8.8	310000	50	6.7/7.6
	8	1	2.2	ND	ND	1184	111						
	10	2	0.9	ND	ND	245	10						
	11	2	5.3	ND	ND	739	67						
	12	2	1.4	ND	ND	164	11						
	13	2	0.9	ND	ND	165	9						
	30	3	1.0	ND	ND	740	18						
	Instant. Min/Max pH												**4.8/7.5**
	Event/Daily Max									**8.8**		**2586**	
	Monthly Total/Avg/GeoMean	**3**	**177.06**	**2**	**144.27**	**134,368**	**123,035**	**8.4%**			**164**		
February	26	1	1.5	ND	ND	690	22						
	27	1	21.5	1	19.08	26458	25557		3.0		1/1	3,805	5.8/8.8
	28	1	35.5	1	30.39	14370	13926		0.9	2.0	1	4,303	5.9/7.8
	Instant. Min/Max pH												**5.8/8.8**
	Event/Daily Max									**2.0**		**4303**	
	Monthly Total/Avg/GeoMean	**1**	**58.53**	**1**	**49.47**	**41,518**	**39504**	**4.9%**			**1**		
March	1	1	4.8	ND		8,928	744						
	2	1	0.4	ND		13,373	743						

	3	1	0.4	ND		233	14						
	14	2	1.7	ND		552	31						
	18	3	0.9	ND		5,439	233						
	19	3	0.4	ND		723	41						
	21	4	0.5	ND		159	11						
	23	5	0.7	ND		44,861	2,125						
	31	6	0.2	ND		244	11						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**6**	**9.99**	**ND**	**ND**	**74,512**	**3,952**	**94.7%**			**ND**		
April	3	1	4.7	1	3.6	3,130	2,501		1.6		20	566	6.1/7.1
	4	1	7.1	ND		985	101			1.6			
	5	1	0.5	ND		79	3						
	9	2	0.6	ND		803	25						
	18	3	0.4	ND		496	20						
	21	4	1.4	ND		518	19						
	25	5	0.5	ND		126	4						
	30	6	0.3	ND		63	2						
	Instant. Min/Max pH												6.1/7.1
	Event/Daily Max									**1.6**		**566**	
	Monthly Total/Avg/GeoMean	**6**	**15.47**	**1**	**3.58**	**6,200**	**2,676**	**56.8%**			**20**		
May	2	1	1.1	ND		560	25						
	6	2	1.2	ND		5,853	211						
	7	2	0.4	ND		13,238	451						
	12	3	2.7	ND		1,149	49						
	15	4	3.5	ND		748	49						
	16	4	0.4	ND		98	3						
	29	5	2.8	ND		1,033	56						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	

	Monthly Total/Avg/GeoMean	**5**	**12.13**	**ND**	**0.00**	**22,679**	**844**	**96.3%**			**ND**		
June	3	1	1.3	0	ND	361	13						
	4	1	1.1	0	ND	405	16						
	5	1	8.0	1	0.23	510	105		0.6	**0.6**	**310000**	**0**	**6.3/6.8**
	6	1	0.7	0	ND	11,428	320						
	9	2	18.9	2	12.2	42,820	31,548		0.2	**0.2**	**16000/18**	**54**	**6.1/7.3**
	10	2	2.5	0	ND	2,405	102						
	Instant. Min/Max pH												**6.1/7.3**
	Event/Daily Max									**0.6**		**54**	
	Monthly Total/Avg/GeoMean	**2**	**32.44**	**2**	**12.42**	**57,930**	**32,104**	**44.6%**			**4469**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**		
October	22	1	0.6	ND	ND	412	24						
	25	2	0.6	ND	ND	373	15						
	28	3	2.2	ND	ND	398	25						

	30	4	2.6	1	1.6	1165	914		0.70	0.7	78	6	6.1/7.8
	31	4	7.0	ND	ND	2260	336						
	Instant. Min/Max pH												**6.1/7.8**
	Event/Daily Max Monthly Total/Avg/GeoMean	**4**	**13.05**	**1**	**1.60**	**4,609**	**1,314**	**71.5%**		**0.7**	**78**	**6**	
November	1	1	0.9	ND	ND	631	23						
	3	2	0.7	ND	ND	965	60						
	5	3	0.4	ND	ND	296	12						
	6	3	9.9	1	2.4	5509	3734		3.30	3.3	68	229	5.9/6.7
	7	3	2.9	ND	ND	1403	98						
	8	3	0.8	ND	ND	223	11						
	22	4	11.8	2	5.9	9445	7247		2.20	2.2	490/1	110	5.9/7.2
	23	4	1.6	ND	ND	424	22						
	24	4	0.2	ND	ND	107	3						
	25	4	5.7	ND	ND	1318	141						
	26	4	1.4	ND	ND	1145	41						
	27	4	0.8	ND	ND	427	18						
	29	5	10.0	3	8.4	4528	3352		0.60	0.6	230	16	6.3/7.8
	30	5	5.6	ND	ND	724	318				140		
	Instant. Min/Max pH												**5.9/7.2**
	Event/Daily Max Monthly Total/Avg/GeoMean	**5**	**52.61**	**3**	**16.66**	**27,145**	**15,081**	**44.4%**		**2.0**	**64**	**229**	
December	1	1	1.4	ND	ND	139	7						
	9	2	2.6	ND	ND	752	324						
	10	2	5.1	ND	ND	957	628						
	11	2	1.2	ND	ND	1529	97						
	20	3	2.5	ND	ND	1231	32						
	24	4	40.4	1	34.3	12849	11474		0.20	0.2	2300/20	642	5.6/6.8
	25	4	20.9	2	17.7	11071	10535		1.60		1/1	219	3.5/6.6
	26	4	9.9	2	5.9	1823	1382		0.20		1/1	64	4.8/6.3
	27	4	11.7	2	5.2	2574	1670		0.70	0.8	1	87	4.7/7.3
	28	4	2.4	ND	ND	1890	107						
	29	4	1.0	ND	ND	377	26						

	30	4	4.2	ND	ND	515	75						
	Instant. Min/Max pH												3.5/7.3
	Event/Daily Max Monthly Total/Avg/GeoMean	4	103.07	2	63.02	35,707	26,355	26.2%		0.8	4.6	642	
Total		**36**	**474.34**	**12**	**291.02**	**404,668**	**244,865**						
Inst. pH Min/Max													**5.6/7.9**
Max (GEM, SS, TRC)										**8.80**	**0**	**309**	
Annual Average							by mass:	**39%**		**1.9**	**686**	**866**	

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

January–December 2022

Executive Summary

This 2022 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 National Pollutant Discharge Elimination System (NPDES) permit for West Point Treatment Plant (WA0029181).

The year 2022 had 40.27 inches (in.) of rainfall measured at SeaTac, slightly above the 40.06 in. annual average for the past 20 years. Despite a near average amount of annual rainfall, there were several large rain events in January and February that resulted in one of the largest annual discharge volumes from the Henderson/MLK Jr. Way WWTS in recent years.

There were five filling events and three discharge events at the Henderson/MLK Jr. Way WWTS in 2022. The treatment facility received 31.32 million gallons (MG) of combined sewer wastewater and discharged 19.70 MG of treated water to the Duwamish Waterway. The Henderson/MLK Jr. Way WWTS complied with all permit effluent and performance limits in 2022 except for total chlorine residual on January 2.

The first discharge event of the year was the result of 1.86 in. of rain that fell from January 2 to January 3 (as measured by the Henderson Pump Station rain gauge). Total inflow was 5.52 million gallons (MG), and 1.84-MG of treated water was discharged to the Duwamish Waterway.

The second discharge event of the year was the result of 4.25-inches of rain that fell between January 2 and January 7 (as measured by the Henderson Pump Station rain gauge). Total inflow was 11.81 MG, and 8.13 MG of treated water was discharged to the Duwamish Waterway.

The third discharge event of the year was the result of 3.91 in. of rain that fell between February 26 and February 28 (as measured by the Henderson Pump Station rain gauge). Total inflow was 13.41 MG, and 9.73 MG of treated water was discharged to the Duwamish Waterway.

Table F-1 summarizes NPDES permit performance in 2022. Henderson/MLK Jr. Way WWTS complied with all effluent and performance limits in 2022 except for total chlorine residual (TRC) on January 2.

Table F-1. Henderson/MLK Jr. Way WWTS Permit Performance in 2022

Parameter	Performance	Permit Conditions
Annual average effluent settleable solids (ml/L/hr)	0.1	0.3
Annual average total suspended solids removal (%) – all events	61%	50
Instantaneous minimum effluent pH: number of days with pH <6.0	0 out of 5 discharge days	≥ 6.0
Instantaneous maximum effluent pH: number of days with pH >9.0	0 out of 5 discharge days	≤ 9.0
Daily average total residual chlorine (TRC, µg/L): number of days with TRC >39 µg/L	1 out of 5 discharge days	39
Monthly geomean fecal coliform (cfu/100 ml): number of months with >400 cfu/100 mL	0 out of 2 discharge months	400

Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

The 2022 annual average total suspended solids (TSS) removal was 61 percent; the minimum permit limit is 50 percent. The annual average effluent settleable solids of <0.1 milliliters/liter/hour (ml/L/hr) met the annual maximum permit limit of 0.3 ml/L/hr.

Fecal Coliform Bacteria

There were no exceptions to the maximum monthly fecal coliform geomean limit of 400 colony forming units (cfu)/100 ml. The maximum monthly effluent fecal coliform concentration in 2022 was 20 cfu/100 ml.

Total Residual Chlorine

On January 2, the effluent TRC was >41 mg/L, which exceeded the maximum daily TRC of 39 mg/L. For approximately one third of the 4 hours of discharge, the TRC analyzer was reporting its maximum output of 100 mg/L. The theoretical effluent average TRC on January 2 was estimated to be 511 µg/L based on the residual chlorine measured before dechlorination and the stoichiometric TRC decay that would have occurred based on the applied Sodium Bisulfite (SBS volume. The daily average TRC permit limit was met on all other discharge days.

The root cause of the January 2 TRC permit exception was a scaling mismatch in electronic control signal between the SBS pumps and the programmable logic controller. The scaling issue was most likely caused inadvertently when the pumps were tested manually. To prevent inadvertent settings changes (which is remarkably easy with these particular pumps), a keycode is now required to modify chemical pump settings.

Instantaneous Minimum and Maximum Effluent pH

There were no exceptions to the minimum and maximum pH limits. The lowest and highest effluent pH measured in 2022 was pH 6.1 and pH 7.4, respectively.

Operations and Maintenance

Routine operations and maintenance (O&M) activities 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. Preventive maintenance was performed routinely.

Henderson/MLK Jr. Way WWTS Improvements Project

Major equipment modifications and improvements were made to Henderson/MLK Jr. Way WWTS from 2017 through 2019 to address challenges with consistently meeting NPDES permit requirements for disinfection and dechlorination.

2017 improvements

- Levelled the existing inlet and outlet rectangular weirs
- New fine-range bubbler sensors at the tunnel's inlet and outlet weirs
- Flow meters on the NaOCl and SBS chemical dosing lines
- Improved venting of the chemical supply lines

2019 improvements

- New NaOCl chemical feed pumps
- New SBS chemical feed pumps
- A pre-dechlorination total residual chlorine monitoring system
- A strainer on the SBS metering pump suction lines
- Improved exhaust ventilation in the SBS chemical room

2021 Improvements

- Improved local data logging and additional data available remotely

2022 Improvements

- Added security features to chemical pumps to prevent inadvertent rescaling

Planned Improvements

As with all wet weather treatment stations, and especially the Henderson/MLK Jr. Way WWTS, opportunities to optimize operations are limited because of the infrequent number of events; there were only three events in 2022. Given the complexity and "normal" challenges of an intermittently operated WWTS facility, King County Wastewater Treatment Division 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 2022

Month	Day	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ MLK + WP (lbs)	% Removal	Effl. Daily Settl Solids (ml/l/hr)	Effl. Settl Solids Event Avg (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
January	2	1	4.99	1	1.31	7116	1548	78%	0.2	0.2	<1	>41	6.6/7.1
	3	1	0.53	1	0.53	301	181	40%	0.1	0.2	<1	0	6.5/7.3
	6	2	10.31	2	6.63	4127	1636	60%	0.1	0.1	>10,000	23	6.1/6.9
	7	2	1.5	2	1.5	600	370	38%	0.1	0.1	E14	24	6.3/7.0
	Instant. Min/Max pH												**6.1/7.3**
	Event/Daily Max									**0.20**		**>41**	
	Monthly Total/Avg/GeoMean	**2**	**17.33**	**2**	**9.97**	**12,145**	**3,735**	**69%**			**20**		
February	27	1	1.08	0	0	793	79	90%					
	26	1	12.33	1	9.73	4936	3257	34%	0.1	0.1	E3 / <1	6	
	Instant. Min/Max pH												**6.4/7.4**
	Event/Daily Max									**0.10**		**6**	
	Monthly Total/Avg/GeoMean	**1**	**13.41**	**1**	**9.73**	**5,729**	**3,336**	**42%**			**2**		
March -- November	No Inflow/No Disch.												
December	24	1	0.58	0	0.0	261	47	82%	**ND**	**ND**	**ND**	**ND**	**ND**
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	

	Monthly Total/Avg/GeoMean	1	0.58	0	0.0	261	47	82%			ND		
Total		**4**	**31.32**	**3**	**19.70**	**18,135**	**7,119**						
Inst. pH Min/Max													**6.1/7.4**
Max (GEM, SS, TRC)											**20**	**>41**	
Annual Average							by mass:	**61%**		**0.1**	**11**	**19**	