KING COUNTY SEDIMENT MANAGEMENT PLAN 2018 UPDATE

Prepared for

King County Department of Natural Resources and Parks Sediment Management Program

Sediment Management Plan Update Project

Prepared by

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September 2018

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	microgram per kilogram
AET	apparent effects threshold
ARAR	applicable or relevant and appropriate requirement
BEHP	bis 2 ethyhexyl phthalate
CAP	cleanup action plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/year	centimeter per year
CoC	contaminant of concern
CSL	cleanup screening level
CSO	combined sewer overflow
cy	cubic yard
DCA	disproportionate cost analysis
EBDRP	Elliott Bay/Duwamish Restoration Program
Ecology	Washington State Department of Ecology
EFDC	Environmental Fluid Dynamics Code
ENR	enhanced natural recovery
EPA	U.S. Environmental Protection Agency
EW-OU10	East Waterway Operable Unit
f	freshwater SCO
GSI	green stormwater infrastructure
HPAHs	high-molecular-weight polycyclic aromatic hydrocarbons
LDW	Lower Duwamish Waterway
LPAHs	low-molecular-weight polycyclic aromatic hydrocarbons
LTCP	Long-term Control Plan
m	marine SCO
MG	million gallons
MNR	monitored natural recovery
MTCA	Model Toxics Control Act
NAVD88	North American Vertical Datum 88
NPDES	National Pollutant Discharge Elimination System
PAHs	polycyclic aromatic hydrocarbons

PCBs	polychlorinated biphenyls
PS	pump station
RCW	Revised Code of Washington
ROD	Record of Decision
RS	regulator station
SCO	Sediment Cleanup Objective
SCUM II	Sediment Cleanup Users Manual II
SMA	sediment management area
SMP	Sediment Management Plan
SMS	Sediment Management Standards
TBT	tributyltin
USACE	U.S. Army Corps of Engineers
UW	University of Washington
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WW-OU8	West Waterway Operable Unit No. 8
WWTS	wet weather treatment station

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EXECUTIVE SUMMARY

Overview

This Sediment Management Plan (SMP) update amends the 1999 SMP (King County 1999). The 1999 SMP evaluated remediation alternatives for seven sediment cleanup sites located near King County combined sewer overflows (CSOs). The current SMP Update identifies appropriate sediment management strategies adjacent to each remaining King County CSO outfall location. Sediment quality at other facilities is evaluated on a case-by-case basis in separate reports. This SMP update describes King County CSO discharge locations, summarizes ongoing and previously performed sediment cleanup work, and summarizes the results of CSO solids deposition modeling and existing sediment quality in the CSO discharge areas. This SMP update also evaluates alternative sediment cleanup options for the University Regulator Station (RS) Overflow area to understand potential cost implications of any cleanup required at the site in order to incorporate into long-range planning.

King County CSO Control, Sediment Management Program, and Regulatory Setting

This SMP update has been developed by King County's Sediment Management Program in coordination with the CSO Control Program. CSO discharges have been reduced substantially in the last 20 years with significant CSO control capital projects and reduced loadings to the CSO system via upland land use changes and chemical management practices. However, persistent contaminants in sediments in some locations continue to pose a potential risk to aquatic life, wildlife, and human health. Figure ES-1 shows the King County CSO discharge locations.

King County's Wastewater Treatment Division is responsible for carrying out the CSO Control Program. The CSO Control Program and policies guide King County in controlling CSO discharges and in complying with control regulations as required by Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA). King County manages a total of 39 permitted CSO outfalls; collectively, these CSOs are regulated under the National Pollutant Discharge Elimination System (NPDES) permit for the West Point Treatment Plant (Permit No. WA-002918-1; renewal effective February1, 2015) and the 2013 Consent Decree (Civil Action No. 2:13-cv-677) between the U.S. Department of Justice, EPA, Ecology, and King County. There are also four CSO treatment plants that have outfalls that are also regulated under the NPDES permit and consent decree.

Figure ES-1

King County CSO Discharge Locations

The current NPDES permit requires King County to complete and report on characterization of sediment at all CSO locations by December 31, 2018, using an appropriate combination of sediment sampling and discharge modeling. Consistent with NPDES permit conditions, this SMP update describes the status of sediment characterization of all 39 King County CSOs and the four CSO treatment plant outfalls. These characterization results are compared to Sediment Management Standards (SMS; Washington Administrative Code 173-204). For CSOs that discharge into designated Superfund sites, sediment is being evaluated consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; 40 Code of Federal Regulations Part 307) and administered by EPA.

CSOs that are Being Addressed in Ongoing Cleanups

Sediment quality associated with fourteen CSOs and two CSO Treatment Plant (TP) outfalls have been previously characterized, and 1) have been previously remediated; 2) are currently being addressed as part of area-wide sediment cleanup efforts; or 3) are being addressed under the original 1999 SMP (Table ES-1). Eleven of these CSOs are located within the Lower Duwamish Waterway (LDW) Superfund Site Boundary, and two CSOs are located within the Harbor Superfund Site Boundary (East Waterway Operable Unit). These CSOs are not evaluated in this SMP update because they are being addressed as part of their respective Superfund cleanups. Any sediment cleanup actions as needed near these CSOs will be undertaken as a part of area-wide cleanup efforts.

CSO and CSO TP Outfall Sediments Addressed by the LDW Superfund Site

- Hanford #1 Overflow
- Duwamish PS Overflow
- W Duwamish Overflow
- Brandon St. RS Overflow
- Terminal 115 Overflow
- S Michigan St. RS Overflow
- W Michigan St. RS Overflow
- E Marginal Way PS Overflow
- 8th Ave. S Overflow
- Norfolk St. Overflow
- Henderson/MLK Outfall

CSO Sediments Addressed by the Harbor Island Superfund Site East Waterway Operable Unit

- Hanford #2 RS Overflow
- Lander St. RS Overflow

CSO and CSO TP Outfall Sediments Addressed by King County under 1999 SMP

- King St. RS Overflow
- Denny Way RS Overflow
- Elliott West Outfall

Source control and sediment cleanup actions were previously performed by King Country at the Denny Way RS Overflow/Elliott West Outfall, and were also identified for further monitoring in the 1999 SMP. Informed by recent sediment monitoring results, King County is currently performing additional cleanup evaluations in the Denny Way area, consistent with the requirements of an Agreed Order with Ecology. Similarly, sediment cleanup actions adjacent to the King St. RS Overflow were also identified for cleanup evaluations in the 1999 SMP to be performed as part of future redevelopment of this area, which continues to be the case. Therefore, these two sites are also not re-evaluated in this SMP update.

Marine CSO and CSO TP Outfall Sediments Evaluated in the SMP

- Carkeek Outfall
- North Beach PS WW Overflow
- North Beach PS Inlet Overflow
- S Magnolia Overflow
- 53rd Ave. SW PS Overflow
- Alki Outfall
- 63rd Ave. SW PS Overflow
- SW Alaska St. Overflow
- Murray St. PS Overflow
- Barton St. PS Overflow
- Kingdome RS Overflow
- Chelan Ave. RS Overflow
- Harbor Ave. RS Overflow

Freshwater CSO and CSO TP Outfall Sediments Evaluated in the SMP

- Ballard Siphon Overflow
- 11th Ave. NW Overflow
- 3rd Ave. W Overflow
- Canal St. Overflow
- Dexter Ave. RS Overflow
- University RS Overflow
- Montlake RS Overflow
- Matthews Park PS Overflow
- Belvoir PS Overflow
- 30th Ave. NE Overflow
- E Pine St. PS Overflow
- Rainier Ave. PS Overflow
- MLK Jr. Way Overflow
- Henderson St. PS Overflow

CSOs that are Being Addressed in the SMP

The remaining 25 CSOs and two CSO TP Outfalls are evaluated in this SMP update. Thirteen are located in marine environments of Puget Sound and Elliott Bay and another 14 are located in freshwater environments of Lake Washington, the Lake Washington Ship Canal, Lake Union, and Portage Bay.

Note that Harbor Ave. RS Overflow and Chelan Ave. RS Overflow are located in the Harbor Island Superfund Site Boundary (West Waterway Operable Unit), but they are evaluated in this update because although no cleanup was required, the cleanup decision could be revisited if cleanup goals are not met.

Table ES-1

Lines of Evidence and Sediment Management Strategies for CSOs

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observable Sediment Concentrations?	Sediment Management Strategy
Central Basin of Puget Sound								
046	Carkeek Outfall	No	Treated	n/a	No; no CSL exceedances	None	No	No Further Action
048a	North Beach PS WW Overflow	No	Controlled	No	No; no CSL exceedances	None	No	No Further Action
048b	North Beach PS Inlet Overflow	No	Controlled	n/a	No data within 600 feet	None	n/a	Additional Evaluation
006	S Magnolia Overflow	No	Uncontrolled	No	No; no CSL exceedances	Other CSO, stormwater outfalls, marina activities	No	No Further Action
052	53rd Ave. SW PS Overflow	No	Controlled	No	No; no CSL exceedances	Not evaluated - no exceedances	No	No Further Action
051	Alki Outfall	No	Treated	n/a	No; no CSL exceedances	63rd Ave Pump Station CSO, stormwater outfalls	No	No Further Action
054	63rd Ave. SW Overflow	No	Controlled	No	No; no CSL exceedances	Alki CSO Treatment Plant, stormwater outfalls	No	No Further Action
055	SW Alaska St. Overflow	No	Controlled	No	No; no CSL exceedances	None	No	No Further Action
056	Murray St. PS Overflow	No	Uncontrolled	No	No; 2 CSL exceedance locations are isolated and bounded by other sample locations; there is no combination of three stations where the average exceeds the CSL for either chemical	Adjacent CSO, stormdrain	Isolated exceedance could be attributable to SD or CSOs	No Further Action
057	Barton St. PS Overflow	No	Uncontrolled	No	No; 2 CSL exceedances from 2016 are different chemicals and there is no combination of three stations where the average exceeds the CSL for either chemical 2016 sampling indicates sediments have recovered	Adjacent CSO, stormdrain, creosote pilings (ferry terminal)	Yes	Additional Evaluation
Elliott Bay								
027a/027b	Denny Way RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
027b	Elliott West Outfall	Yes	Treated	n/a	n/a	n/a	n/a	Part of Existing Cleanup
028	King St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observable Sediment Concentrations?	Sediment Management Strategy
029	Kingdome RS Overflow	No	Uncontrolled	Yes for BEHP	No; area was dredged in 2005 and existing post-dredging sample does not exceed CSL for any chemical	Adjacent stormwater outfalls and creosote piling	Yes	Additional Evaluation
East and West Waterway								
030	Lander St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Separate Cleanup
032	Hanford #2 RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Separate Cleanup
036	Chelan Ave. RS Overflow	Yes; at site boundary	Uncontrolled	No	Yes; cluster of potential concern for BEPH	Nearby stormwater outfall and piling	Yes	Additional Evaluation
037	Harbor Ave. RS Overflow	Yes; at site boundary	Uncontrolled	Yes for BEHP	Yes; historical cluster of potential concern for BEPH	Nearby CSO and Longfellow Creek discharge out the same outfall.	Yes	No Further Action (under existing cleanup)
Lake Washington Ship Canal/Lake Union/Portage Bay								
003	Ballard Siphon Overflow	No	Controlled	No	Yes; cluster of potential concern for mercury	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	Evaluate as Part of Area-Wide Investigation
004	11th Ave. NW Overflow	No	Uncontrolled	Yes for silver	Yes; historical cluster of potential concern for cadmium and nickel	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	Evaluate as Part of Area-wide Investigation
008	3rd Ave. W Overflow	No	Uncontrolled	Yes for silver	Yes; cluster of potential concern for total PAHs	3rd Ave., Canal Street and another CSO are proximal to each other. Adjacent stormwater outfalls and ship activity in the ship canal.	Yes	Evaluate as Part of Area-wide Investigation
007	Canal St. Overflow	No	Controlled	No	Likely; proximity to 3rd Avenue CSO indicates similar levels of contamination	3rd Ave., Canal Street and another CSO are proximal to each other. Adjacent stormwater outfalls and ship activity in the ship canal.	Yes	Evaluate as Part of Area-wide Investigation

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observable Sediment Concentrations?	Sediment Management Strategy
009	Dexter Ave. RS Overflow	No	Controlled	Yes for silver	Yes; historical samples are a cluster of potential concern for multiple metals and organics	A stormwater basin shares the discharge pipe. Adjacent stormwater outfalls and industrial activity in Lake Union.	Yes	Evaluate as Part of Area-wide Investigation
015	University RS Overflow	No	Uncontrolled	Yes for silver, di-n-octyl phthalate, and mercury	Yes; cluster of potential concern for Mercury and PCBs	A stormwater basin shares the outfall. Nearby stormwater outfalls and University vessel activities.	Yes	Cleanup Evaluated in SMP Update
014	Montlake RS Overflow	No	Uncontrolled	Yes for silver	No; no CSL exceedances	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	No Further Action
Lake Washington								
018	Matthews Park PS Overflow	No	Controlled	n/a	No; no CSO-related exceedances expected because Mathews Park Pump Station is controlled	Ambient North Lake Washington conditions	No data	No Further Action
012/049	Belvoir PS Overflow and 30th Ave. NE Overflow	No	Uncontrolled	No	No; no CSL exceedances	Other CSO	Yes	No Further Action
011	E Pine St. PS Overflow	No	Controlled	n/a	No data within 600 feet since 2005 2000 data: No; 0 out of 2 sample locations	Two CSOs	Yes; no recorded King County CSO events	No Further Action
033	Rainier Ave. PS Overflow	No	Controlled	n/a	No data within 600 feet since 2005 2000 data: No; 0 out of 2 sample locations	CSO, stormwater outfalls and shoreline activities	Yes; no recorded King County CSO events	No Further Action
013/045	MLK Jr. Way Overflow and Henderson St. PS Overflow	No	Controlled	n/a	No data within 600 feet since 2005 Historical data (2000, 1995): Yes; 2 out of 3 sample locations; Mercury, total PAHs, Sulfide	A stormwater basin shares the outfall. Nearby CSO, stormwater outfalls, and shoreline activities	Yes; no recorded King County CSO events	Additional Evaluation
Duwamish River								
031	Hanford #1 Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
034	E Duwamish PS Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
035	W Duwamish Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
043	E Marginal Way PS Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
039	S Michigan St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observable Sediment Concentrations?	Sediment Management Strategy
041	Brandon St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
044	Norfolk St. Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
037	Harbor Ave. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
038	Terminal 115 Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
042	W Michigan St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
040	8th Ave. S Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup

Notes:
BEPH = bis(2-ethylhexyl)phthalate
cm/year = centimeters per year
CSL = cleanup screening level
CSO = combined sewer overflow
n/a = not applicable; not evaluated for the CSO
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SD = stormdrain
SMP = Sediment Management Plan
UW = University of Washington
WW = wet well

Summary of CSO Sediment Modeling

King County developed two types of sediment transport models to characterize the magnitude and extent of sediment deposition of CSO-related solids around the CSOs evaluated in this SMP update. Modeling of sediment deposition and estimating SMS exceedances is one line of evidence used to determine sediment management strategy.

A complex Environmental Fluid Dynamics Code (EFDC) model was applied to representative CSOs where detailed input information was available and results were compared to sediment sampling at those locations. Based on the outcome of the initial EFDC modeling and verification with sampling data, a simpler model was subsequently developed that could provide similar order-of-magnitude results as the EFDC model, but could be run more simply and applied to sites where not all the detailed input information for EFDC was available. For multiple CSOs, both models were run to compare the results of each. All model runs were performed using the current discharge volumes and frequencies to predict current sediment deposition patterns. Based on the modeling, deposition rates of CSO solids were found to vary widely between the CSOs. Solids deposition were highest immediately adjacent to the outfalls, and dissipated rapidly at locations further from the overflow.

The CSO solids deposition rate estimates were then used to identify potential SMS chemical criteria exceedances in sediment that triggers further assessment for potential cleanup (i.e., clusters of potential concern). Additional information used in this estimate included chemical concentrations in CSO solids, ambient (non-CSO) sedimentation rates, and chemical concentrations in ambient solids. Both low and high estimates were developed so that the sensitivity to a range of potential effects and uncertainties could be understood. Of 19 CSOs with modeling information, none were identified as a possible SMS cluster of potential concern when using the low estimate, and 6 were identified as a possible SMS cluster of potential of concern when using the high

Contaminants with Possible Clusters of Potential Exceedances, Based on Model Results

Marine

- BEHP for one CSO (Kingdome RS Overflow)

Freshwater

- Silver for five CSOs: (11th Ave. NW Overflow, 3rd Ave. W Overflow, Dexter Ave. RS Overflow, University RS Overflow, Montlake RS Overflow)
- Di-n-octyl phthalate and mercury for University RS Overflow only

estimate. Based on the modeling, CSO-related chemicals that are most likely to result in a SMS cluster of potential concern near discharge locations included bis(2-ethylhexyl)phthalate (BEPH), di-n-octyl phthalate, silver, and mercury.

Summary of Existing Sediment Quality Data

Existing sediment quality data were evaluated for the 25 CSOs and 2 CSO TP outfalls evaluated in this SMP update. Nine of 25 CSOs were identified as having a SMS cluster of potential concern at the site. Chemicals that triggered a SMS cluster of potential concern at one or more CSO sites included BEPH, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), mercury, nickel, cadmium, and sulfide. The sediment quality sampling data were generally consistent with and corroborated the modeling projections. Differences between the sampling data and modeling projections were attributable to unique characteristics of each CSO, other sources of contaminated sediment, or the persistent signal of potential historical releases from the CSO or other sources.

The potential effect of nearby pathways and sources was evaluated qualitatively by reviewing potential releases in the vicinity of each King County CSO (e.g., CSOs, stormwater outfalls, and industrial activities) and comparing the spatial distribution of sediment chemical concentrations in the area to that predicted by modeling. Where measured sediment concentrations were higher and more widely distributed than the upper range predicted by modeled CSO releases, other releases potentially contributed. Based on this review, SMS clusters of potential concern within Lake Washington Ship Canal and Lake Union were identified as being part of larger areas of elevated concentrations with multiple pathways and potential sources. In other cases, one particular pathway or potential source was identified as a potential contributor.

CSO Sediment Management Strategies

The CSO evaluations were synthesized as lines of evidence for identifying a sediment management strategy for each CSO. The lines of evidence included:

- Existing sediment cleanup actions occurring near the CSO discharge location
- CSO control status
- Model predicted CSO solids deposition near the CSO discharge location

- Sediment concentrations near the CSO discharge location
- Nearby pathways and potential sources

Proposed strategies identified for CSOs fall into five groups, as follows (Table ES-1):

1. **Sediments are evaluated as part of an existing cleanup process**
   As discussed in Section 3 of this Executive Summary, 14 CSOs and two CSO TP outfalls discharge into areas designated as cleanup sites under CERCLA or Model Toxics Control Act (MTCA), and are being addressed as part of an existing cleanup process. CSOs being cleaned up under the original SMP are also included in this list.

2. **No further action**
   No further action is appropriate for CSOs and CSO TP outfalls that do not have a SMS cluster of potential concern. These CSOs will not require additional sampling because sediments already comply with SMS; however, these CSOs will continue to be subject to monitoring under the NPDES permit and, if applicable, the Post-Construction Monitoring Plan at completion of CSO control actions, to demonstrate compliance with the SMS. If for any reason CSOs do not meet control criteria, then sediments will require reevaluation once control has been re-established.

   Two CSO treatment plant outfalls required site characterization under past NPDES permits and repeatedly demonstrated compliance with SMS.

   Thirteen CSOs were identified for no further action because either: 1) they have already been controlled, and sediments comply with the SMS; or 2) they are not yet controlled, and sediments comply with the SMS and will not require monitoring post construction because discharges are further reduced.

   There are two cases where post-construction monitoring following control could be required. Murray St. PS Overflow is not a cluster of potential concern, but had PAHs elevated above the CSL in one location, while modeling did not predict any CSL exceedances. Belvoir PS Overflow and co-located 30th Ave. NE Overflow now exceeds the State CSO control standard (based on modeling) and could possibly be

required to demonstrate compliance once brought back under control. Sampling did not indicate a cluster of potential concern, but has only been characterized by one sample, while modeling did not predict CSL exceedances.

3. **Additional monitoring**

   Additional sediment quality monitoring is appropriate for those CSOs, which: a) lack recent sediment quality data; b) have historical data that identified an SMS cluster of potential concern, but recent natural recovery is likely; and c) where modeling projected a potential for SMS criteria exceedances, but has not been confirmed with sampling data. Six CSOs are identified as needing additional evaluations.

   - **North Beach PS Inlet Overflow** has already been controlled in 2015, but this intertidal second overflow location at North Beach PS was not sampled and modeling was determined to not be appropriate for these site conditions. Post-construction monitoring will occur, with results submitted to Ecology.
   - **Barton St. PS Overflow** had exceedances in 2011 but not in the post-construction monitoring performed in 2016. Additional sampling should reoccupy these locations in 5 to 10 years after the last sampling event, to verify likely natural recovery.
   - **Kingdome RS Overflow** had previous exceedances in the 1990s, but the area has been dredged for slip maintenance. Modeling projected a potential for exceedances, although this was not verified with the most recent sampling. Post-construction monitoring will occur once this CSO is controlled.
   - **Chelan Ave. RS Overflow** has been identified as a SMS cluster of potential concern for BEPH, based on 2011 and 2013 sediment sampling, which may be attributable to other sources. Modeling does not predict exceedances attributable to CSO releases alone. EPA issued a No Action decision for this portion of the West Waterway Operable Unit in 2003. The last 5-year review (September 2015) concluded that no additional evaluations are required at this time. However, post-construction monitoring will occur once the CSO is controlled.
   - **MLK Jr. Way Overflow and Henderson St. PS Overflow** shared location has not been sampled since 2000, but was an SMS cluster of potential concern for

PAHs at that time. There are no CSO events on record. Sediments in the area and adjacent pathways and potential sources warrant further evaluation to determine if a cluster of potential concern still exists.

4. **Further evaluate in the context of area-wide investigation (not evaluated at this time)**
   Further evaluation is appropriate for those CSOs that have SMS clusters of potential concern, but concentrations of those or other chemicals are elevated throughout the area and other nearby sources exist. Five CSOs are located in highly developed areas in Lake Washington Ship Canal/Lake Union with sediments affected from multiple pathways and potential sources. Two CSOs have recent sediment quality, and thus do not require additional local sampling. The other three CSOs will require additional sediment evaluations when an area-wide investigation is conducted.

5. **Further evaluate in this SMP update**
   Further evaluation of cleanup options was performed in this SMP update for the University RS Overflow, identified as an SMS cluster of potential concern based on recent sampling, consistent with modeling projections. This CSO is currently undergoing control work. Green stormwater infrastructure (GSI) is currently being designed to reduce flows to the University RS Overflow. In addition, the design for a storage tank to complete control will commence in 2022, and be constructed by approximately 2029. Prior to construction of the storage tank, sources will be characterized and traced and recontamination potential will be reassessed. It is anticipated that this information will be used to inform the development of a Cleanup Action Plan and a preferred cleanup alternative. Based on modeling, cleanup activities should not commence until after the storage tank is constructed, to minimize recontamination potential. This assumption can be revisited following GSI completion and further source characterization.

Next Steps

This SMP update presents a number of lines of evidence to identify the appropriate sediment management strategy for each CSO. Additional actions will proceed in coordination with CSO control activities by King County's Wastewater Treatment Division. Any further

actions needed at fourteen CSOs and two CSO TP Outfalls will proceed under processes that have already been initiated. Fourteen CSOs and two CSO TP Outfalls will not need further action beyond routine CSO monitoring requirements because there are no impacts either observed or projected. Five CSOs will be monitored further under existing requirements so that sediment quality can be further evaluated. Five CSOs were identified as requiring further assessment, but they are located within area-wide elevated concentrations that will require broader analysis to be initiated under an area-wide investigation process. Finally, University RS Overflow was likely to be identified as a cleanup site and underwent a preliminary evaluation of cleanup alternatives in this SMP to develop planning-level cost estimates for long-range planning. Sediment cleanup is assumed at this time to commence following CSO control due to modeled recontamination potential.

1 INTRODUCTION

This Sediment Management Plan (SMP) update amends the 1999 SMP (King County 1999). The 1999 SMP evaluated remediation alternatives for seven sediment cleanup sites located near King County combined sewer overflow (CSO). The current SMP Update identifies appropriate sediment management strategies adjacent to each remaining King County CSO outfall location. Sediment quality at other facilities is evaluated on a case-by-case basis in separate reports. This SMP update describes all of the 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. Anticipating that cleanup will be required for one CSO based on the analysis, this SMP update also develops and compares sediment cleanup alternatives for sediments impacted by the University Regulator Station (RS) Overflow to understand the potential cost implications of any cleanup required at this site in order to incorporate into long-range planning.

This SMP update was developed by King County's Sediment Management Program in coordination with the County's CSO Control Program. CSO discharges have been reduced substantially in the last 20 years with significant CSO control capital projects and reduced loadings to the CSO system via upland land use changes and chemical management practices. However, persistent contaminants in sediments in some locations continue to pose a potential risk to aquatic life, wildlife, and human health. This SMP update proposes a strategy for assessing and managing potential or determined sediment impacts related to the County's CSOs, in order to meet permit obligations as well as provide information needed to plan for required or anticipated future cleanup actions.

The rest of this section provides an overview of CSO control and the sediment management program, summarizes the 1999 SMP, and reviews the key regulatory standards for sediment quality.

1.1 CSO Control and the Sediment Management Program

King County's Wastewater Treatment Division is responsible for carrying out the CSO Control Program. The CSO Control Program and policies are intended to guide King County in controlling CSO discharges and in complying with control regulations as required by

Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA). King County manages a total of 39 permitted CSO outfalls; collectively, these CSOs are regulated under the National Pollutant Discharge Elimination System (NPDES) permit for the West Point Treatment Plant (Permit No. WA-002918-1; renewal effective February 1, 2015) and the 2013 Consent Decree (Civil Action No. 2:13-cv-677) between the U.S. Department of Justice, EPA, Ecology, and King County. There are also four CSO treatment plants that have outfalls that are also regulated under the NPDES permit and consent decree.

Efforts to bring King County's CSO system into control have been ongoing since the mid-1970s and have included a series of CSO control program policies, performance standards, and planning documents (King County 1995, 1999, 2008, 2012a). The most recent Long-Term CSO Control Plan Amendment (King County 2012a) provides the current strategies for reducing or mitigating the effects of CSOs, including pollution prevention through source control, stormwater management, operational controls to transfer as much captured overflow as possible to regional treatment plants, upgrades of existing facilities, and construction of new CSO control facilities. The most recent annual CSO report provides the most recently updated status of CSO control activities (King County 2016). Table 1-1 presents the control status of each CSO, and Figure 1-1 shows the King County CSO discharge locations.

Sediment quality that may be affected by CSO discharge locations is managed under King County's Sediment Management Program. King County has conducted numerous sediment monitoring projects since the early 1990s as necessary to identify areas where sediment quality exceeds applicable criteria. Key objectives of the Sediment Management Program include:

- Implement strategies for sediment quality issues near CSOs and outfalls[1]
- Evaluate and address emerging wastewater treatment sediment quality issues
- Incorporate sediment quality considerations into comprehensive planning

[1] For the King County CSO system, "outfalls" refers to discharge locations for treatment facilities, and "overflows" refers to discharge locations for untreated overflows. For this document, CSOs are named by their discharge locations, and the general term "discharge location" refers to either an outfall or an overflow.

Table 1-1
Summary of King County CSO and CSO Treatment Plant Discharge Locations and Control Status

CSO Number	CSO Discharge	Abbreviated Name	CSO Control Status (KC 2017)[a]	Within the Boundary of an Existing Sediment Cleanup Site?
Central Basin of Puget Sound				
046	Carkeek Outfall	Carkeek Outfall	Treated	No
048a	North Beach Pump Station Wet Well Overflow	North Beach PS WW Overflow	Controlled	No
048b	North Beach Pump Station Inlet Overflow	North Beach PS Inlet Overflow	Controlled	No
006	South Magnolia Overflow	S Magnolia Overflow	Uncontrolled	No
052	53rd Avenue Southwest Pump Station Overflow	53rd Ave. SW PS Overflow	Controlled	No
051	Alki Outfall	Alki Outfall	Treated	No
054	63rd Avenue Southwest Overflow	63rd Ave. SW Overflow	Controlled	No
055	Southwest Alaska Street Overflow	SW Alaska St. Overflow	Controlled	No
056	Murray Street Pump Station Overflow	Murray St. PS Overflow	Uncontrolled	No
057	Barton Street Pump Station Overflow	Barton St. PS Overflow	Uncontrolled	No
Elliott Bay				
027a	Denny Way Regulator Station Overflow	Denny Way RS Overflow	Uncontrolled	Cleanup performed in 2007 and 2008; additional evaluations are being performed by KC
027b	Elliott West Outfall	Elliott West Outfall	Treated	No
028	King Street Regulator Station Overflow	King St. RS Overflow	Uncontrolled	Cleanup evaluations are being performed by KC
029	Kingdome Regulator Station Overflow	Kingdome RS Overflow	Uncontrolled	No
East and West Waterway				
030	Lander Street Regulator Station Overflow	Lander St. RS Overflow	Uncontrolled	East Waterway Superfund site
032	Hanford #2 Regulator Station Overflow	Hanford #2 RS Overflow	Uncontrolled	East Waterway Superfund site
036	Chelan Avenue Regulator Station Overflow	Chelan Ave. RS Overflow	Uncontrolled	West Waterway Superfund site
037	Harbor Avenue Regulator Station Overflow	Harbor Ave. RS Overflow	Uncontrolled	West Waterway Superfund site
Lake Washington Ship Canal/Lake Union/Portage Bay				
003	Ballard Siphon Overflow	Ballard Siphon Overflow	Controlled	No
004	11th Avenue Northwest Overflow	11th Ave. NW Overflow	Uncontrolled	No
008	3rd Avenue West Overflow	3rd Ave. W Overflow	Uncontrolled	No
007	Canal Street Overflow	Canal St. Overflow	Controlled	No
009	Dexter Avenue Regulator Station Overflow	Dexter Ave. RS Overflow	Controlled	No
015	University Regulator Station Overflow	University RS Overflow	Uncontrolled	No
014	Montlake Regulator Station Overflow	Montlake RS Overflow	Uncontrolled	No
Lake Washington				
018	Matthews Park Pump Station Overflow	Matthews Park PS Overflow	Controlled	No
012	Belvoir Pump Station Overflow	Belvoir PS Overflow	Uncontrolled	No
049	30th Avenue Northeast Overflow	30th Ave. NE Overflow	Controlled	No
011	East Pine Street Pump Station Overflow	E Pine St. PS Overflow	Controlled	No
033	Rainier Avenue Pump Station Overflow	Rainier Ave. PS Overflow	Controlled	No
013	Martin Luther King Junior Way Overflow	MLK Jr. Way Overflow	Controlled	No
045	Henderson Street Pump Station Overflow	Henderson St. PS Overflow	Controlled	No
Duwamish River				
031	Hanford #1 Overflow	Hanford #1 Overflow	Uncontrolled	LDW Superfund site
034	East Duwamish Pump Station Overflow	E Duwamish PS Overflow	Controlled	LDW Superfund site
035	West Duwamish Overflow	W Duwamish Overflow	Controlled	LDW Superfund site
043	East Marginal Way Pump Station Overflow	E Marginal Way PS Overflow	Controlled	LDW Superfund site
039	South Michigan Street Regulator Station Overflow	S Michigan St. RS Overflow	Uncontrolled	LDW Superfund site
041	Brandon Street Regulator Station Overflow	Brandon St. RS Overflow	Uncontrolled	LDW Superfund site
044a	Norfolk Street Overflow	Norfolk St. Overflow	Controlled	LDW Superfund site
044b	Henderson / MLK Outfall	Henderson / MLK Outfall	Treated	LDW Superfund site
038	Terminal 115 Overflow	Terminal 115 Overflow	Uncontrolled	LDW Superfund site
042	West Michigan Street Regulator Station Overflow	W Michigan St. RS Overflow	Uncontrolled	LDW Superfund site
040	8th Avenue South Overflow	8th Ave. S Overflow	Controlled	LDW Superfund site

Notes:

[a] As reported in King County 2017 (Combined Sewer Overflow Control Program 2016 Annual CSO and Consent Decree Report)

CSO = combined sewer overflow

KC = King County

LDW = Lower Duwamish Waterway

n/a = not applicable

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Figure 1-1
CSO Discharge Locations
King County Sediment Management Plan

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The previous version of the NPDES permit (renewal effective date July 1, 2009) required a Comprehensive Sediment Quality Summary Report for CSO treatment plant outfalls and all other CSO outfalls by December 31, 2009, to provide information for an assessment, based on existing information of the potential for sediment impacts from CSO discharges and provide a basis for determining data gaps (permit condition S.18.J). Ecology determined from that report which CSO locations required sediment monitoring to address data gaps and evaluate compliance with the sediment management standards (Podger 2010). In response, the County developed an approach to characterize sediment quality through sampling and modeling at CSO locations (the results of which are presented in this SMP update), completed sampling in 2011, and submitted the data report as required in 2012 (King County 2012). Additionally, the County prepared a Post-Construction Monitoring Plan (King County 2012b) that outlines the County's required process for sediment characterization, hazard assessment/site identification, and cleanup actions (where necessary), and data reporting (permit condition S.18.F).

The current NPDES permit requires King County to report on sediment characterization by sampling or modeling at all controlled CSO locations by December 31, 2018 (permit condition S.13.B).[2] The NPDES permit also requires King County to demonstrate how all controlled CSOs (permit table 6) and any CSO controlled during the permit term comply with sediment quality standards in a Post-Construction Monitoring Summary Report by December 1, 2019 (permit condition S.11.F). As CSOs are controlled in the future, the Post-Construction Monitoring Plan requires sediment to be characterized by sampling or modeling to demonstrate compliance with sediment management standards. Consistent with the past and present NPDES permit conditions, this SMP update describes the status of sediment characterization of all 39 King County CSOs and the four CSO treatment plant outfalls.

Collectively, these permit requirements collect the information needed for agencies to assess whether cleanups will be required. Where cleanups are required, they are performed in coordination with Ecology and consistent with the cleanup requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D RCW, as administered by Ecology under the MTCA

[2] The deadline is December 1, 2018 for 5 controlled CSOs in Lake Washington.

Cleanup Regulation, Chapter 173-340 WAC and the SMS, Chapter 173-204 WAC. King County will also coordinate any actions with any other potentially responsible parties that have contributed releases to that site. For discharge locations in federally designated Superfund sites, cleanups are performed consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and its implementing regulations, 42 U.S.C. sec. 9601 et seq. and 40 C.F.R. Part 307, and administered by EPA, but are still required to comply with sediment standards under MTCA and the SMS.

1.2 Sediment Management Plan Update

The 1999 SMP identified and evaluated programmatic long-range remediation alternatives for consideration at seven areas near King County CSOs that were listed on the Washington State Contaminated Sites list. These areas were assessed for potential risk, preferred cleanup approach, partnering opportunities, and potential for recontamination following remediation.

The 1999 SMP was adopted as part of the Regional Wastewater Services Plan (King County 1999) and highlighted that sediment management needed to be a factor in CSO control planning and the need to develop better information about CSOs as a potential ongoing or historical contributor to sediment contamination. Consistent with the requirements of the SMS, the 1999 SMP conducted alternatives analyses and proposed preferred remedies for the seven sites where appropriate. The Sediment Management Program worked with agencies and other responsible parties to develop and implement cleanup action plans as required under MTCA and SMS.

This SMP update carries forward the concepts and approach identified in the 1999 SMP and provides a recommended strategy for addressing sediment quality issues in relation to current conditions, current regulatory requirements, and planning priorities. Consistent with NPDES permit conditions and to support long-range planning, this update describes the status of sediment characterization through sampling or modeling of all 39 King County CSOs and the four CSO treatment plant outfalls. Some, but not all, of this information is required for the two permit reports due December 2018 and the update to the CSO sediment characterization report due in December 2019. Sediment characterization at each site was assessed for clusters of potential concern or model predictions of Cleanup Screening Level

(CSL) exceedances. The characterization results are reviewed, and a recommended approach is identified for each CSO.

1.3 Sediment Management Standards

Sediment sites in Washington State are regulated by the SMS (Chapter 173-204 WAC). The revised SMS rule was implemented on September 1, 2013 (Ecology 2013) and includes specific requirements for the protection of both the environment and human health. It also provides that where sediment data exists, that data will be assessed for exceedances, and any exceedances (clusters of potential concern; WAC 173-204-510) will then have a hazard assessment and, and if warranted, be identified as a cleanup site (WAC 173-204-520).

For each exposure pathway for human and ecological receptors identified for a site, the SMS provide methods for calculating lower potential screening levels, or Sediment Cleanup Objective (SCO), and higher potential screening levels, or CSL. For benthic toxicity, the SCO is the criterion at which no adverse effects occur, including no acute or chronic adverse effects on biological resources. The CSL is the minor adverse effects level, which is the minimum level to be achieved in all cleanup actions under the SMS. Under the SMS, the SCO and CSL concentration standards have been established for chemical contaminants for protection of the benthic community for both marine and freshwater sediments; these concentrations are used for screening levels in this document. For this document, the benthic standards were assumed to be protective of other ecological receptors, which would be assessed during site-specific cleanups.

The SMS rule also includes specific procedures to determine human health risk-based SCOs and CSLs to address the bio-accumulative (seafood consumption) and direct contact exposure pathways (WAC 173-204-560). These screening levels are calculated on a site-specific basis, are applied on an area-wide basis, and take into account background concentrations and other considerations. Screening levels are not developed for these exposure pathways in this document for the following reasons:

- These screening levels are applied on spatial scales significantly larger than the areas with elevated concentrations from CSO discharges.

- Remediating based on benthic screening levels will also address effects from bio-accumulative chemicals.
- There are insufficient data to currently determine regional background values in most locations.

Regional background has recently been calculated in a draft document by Ecology for Lake Washington (Ecology 2016); however, these preliminary values are not used for screening in this document; regional background concentration values would be developed in cleanup action plans for individual sites.

1.4 Document Organization

The information contained in this report has been organized as follows:

- **Section 2 – Sediment Management Plan Sites:** Section 2 provides background regarding the status of King County CSO discharge locations, including the following:
  - CSO control status
  - Sediment cleanup status
  - Summary of modeling information
  - Summary of existing sediment data
  - Sediment management strategy for CSOs
- **Section 3 – Sediment Cleanup Evaluation:** For University RS Overflow, an analysis of potential remedial actions is performed. This analysis includes the following:
  - Summary of existing conditions and remediation area
  - Development of preliminary cleanup standards
  - Screening of applicable remedial technologies
  - Development and comparison of remedial alternatives
  - Recommendations
- **Section 4 – Conclusions and Next Steps:** This section summarizes preceding analyses and develops the next steps for sediment management, including further modeling, monitoring, cleanup, and reporting for the CSOs.
- **Section 5 – References:** This report builds on many previous documents. Applicable references cited in this report are listed in Section 5.

- **Appendices:** Supporting technical information is presented in Appendices A through D:
  - Appendix A CSO Solids Deposition Modeling
  - Appendix B CSO Solids Chemistry
  - Appendix C Existing Sediment Quality Data
  - Appendix D Review of Federal and State Laws, Regulations, and Standards

2 SEDIMENT MANAGEMENT PLAN SITES

This section provides an overview of the 39 CSOs and four CSO treatment plant outfalls that King County manages, including a summary of CSO control status, cleanup status, modeling information, and existing conditions. This information is used to identify an appropriate sediment management strategy for each CSO.

2.1 CSO Control Status

King County (or Metro) has been performing CSO control measures since first adopting the Combined Sewer Overflow Control Program in 1979. The goal of CSO control is to meet or exceed Ecology's control standard of no more than one untreated discharge per year over the moving 20-year average at each CSO location. The updated source control statuses for the CSOs are presented in King County 2016 and summarized in Table 1-1.

Construction of CSO control facilities in the region began in the late 1970s. So far, about $360 million (2010 dollars) has been spent to control CSOs and another $711 million is planned to implement the CSO control projects in the 2012 Long-term Control Plan (LTCP) Update. Many early projects involved sewer separation, flow diversion, and storage tunnels. Most current and future projects involve construction of storage tanks and wet weather treatment facilities.

Based on current monitoring information, 19 of King County's 39 CSOs are controlled to Ecology's standard (Table 1-1). The remaining 20 uncontrolled CSOs will meet state standards as capital improvement projects are completed between 2013 and 2030. There are also four treated discharges.

2.2 Sediment Cleanup Status

Of the 42 discharge locations, 27 (25 CSOs and two CSO treatment plant outfalls) have their sediment characterized and sediment management strategy established in this study. The other 16 (14 CSOs and two CSO treatment plant outfalls) are part of existing cleanups and are not re-evaluated in this study. The following sections describe existing cleanups, review the status of sites identified for action in the 1999 SMP, and list the CSOs and CSO treatment plant outfalls remaining for further analysis.

2.2.1 Existing Cleanups

Fourteen CSOs and two treatment plant outfalls have had sediment characterized and any needed remediation performed or are being studied as part of area-wide sediment cleanups (Table 1-1). Ten CSOs and one treatment plant outfall are located within the Lower Duwamish Waterway (LDW) Superfund Site Boundary, and two CSOs are located within the Harbor Island Superfund Site Boundary (East Waterway Operable Unit). These CSOs and treatment plant outfalls are not evaluated in this SMP update because they are being evaluated and addressed where necessary as part of their respective Superfund cleanups. As a result, these sites have met the sediment characterization requirement and any needed actions have or will be taken under those area-wide cleanups.

Two CSOs and one treatment plant outfall – Denny Way RS Overflow, Elliott West Outfall and King St. RS Overflow – had previously been identified for cleanup in the 1999 SMP, as described in the next section. The identified need for cleanup at these sites remains valid to date, and these CSOs and outfall are therefore not re-evaluated in this SMP update.

The two final CSOs, Harbor Ave. RS Overflow and Chelan Ave. RS Overflow, are located in the Harbor Island Superfund Site Boundary (West Waterway Operable Unit), but they are evaluated in this update because that unit has already completed its cleanup decision and no cleanup was required in those locations. The progress to meeting cleanup goals is assessed during 5-year reviews, which could result in revising the cleanup decision if goals are not met.

2.2.2 Status of 1999 SMP Sites

The 1999 SMP prioritized seven CSO discharge areas for remedial evaluation and proposed remedial strategies and partnering opportunities for each site (Table 2-1).

Table 2-1

Status of 1999 SMP Sites

CSO	Water Body	1999 SMP Cleanup Priority	Recommended Remedial Action	Partnering Opportunity	Date Completed	Cleanup Status
Duwamish PS/Diagonal Stormdrain	LDW	High	Dredging and capping	City of Seattle under direction of EBDRP	2003/2004	Completed. Additional cleanup evaluations ongoing as part of LDW cleanup (CERCLA process).
King St. RS Overflow	Elliott Bay	High	Capping	WSDOT and City of Seattle	—	Will pursue partnering agreement with WSDOT and City of Seattle to conduct site assessment and corrective action plan.
Denny Way RS Overflow/Elliott W Outfall	Elliott Bay	Medium	Dredging and capping	—	2007/2008	Completed interim cleanup; final cleanup evaluations being performed by King County.
Hanford #2 RS Overflow	East Waterway, LDW	Medium	Dredging and confined aquatic disposal	Port of Seattle	—	Ongoing as part of East Waterway Operable Unit (CERCLA process).
Lander St. RS Overflow	East Waterway, LDW	Medium	Dredging and confined aquatic disposal	U.S. Army Corps of Engineers	—	Interim removal in 2009 as part of berth deepening project. Additional cleanup evaluations ongoing as part of the East Waterway Operable Unit (CERCLA process).
Brandon St. RS Overflow	LDW	Low	Capping	—	—	Ongoing as part of LDW cleanup (CERCLA process).
Chelan Ave. RS Overflow	West Waterway, LDW	Low	Dredging and confined aquatic disposal	—	2003	EPA No Action ROD for Harbor Island Superfund Site West Waterway Operable Unit (WW-OU8). Possible additional evaluations will be made through the CERCLA process. Sediments are also reevaluated in this SMP update.

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EBDRP = Elliott Bay/Duwamish Restoration Program
LDW = Lower Duwamish Waterway
PS = pump station
ROD = Record of Decision
RS = regulator station
SMP = Shoreline Master Program
WSDOT = Washington State Department of Transportation
WW = West Waterway

The following describes the current conditions for each of the 1999 SMP sites:

- **E. Duwamish PS Overflow/ Diagonal Stormdrain (Hanford #1 Overflow):** As identified in the 1999 SMP, the sediment cleanup study was completed as an independent cleanup action under the direction of the Elliott Bay/Duwamish Restoration Program (EBDRP). During 2001 and 2002, cleanup plans were developed to remove contaminated sediments including five acres adjacent to the CSO and Diagonal Site stormdrain and an additional two acres to remove an adjacent upstream "hot spot" (Ecology 2002). Source control efforts, including pipe cleaning and inspections throughout the drainage basin, were conducted. Partial cleanup at the Duwamish PS/Diagonal Site began in November 2003 and was completed in March 2004. A follow-up action was performed in February 2005 to remediate residual contamination in surrounding portions of the hot spot dredge area. Long-term monitoring of the site concluded. The site met cleanup and monitoring goals, and no further monitoring is recommended (King County 2015). The Duwamish PS/Diagonal Site sediment cleanup is currently being regulatorily managed under the LDW Superfund site. Source control activities continue in the basin.
- **King St. RS Overflow:** The remedial strategy presented in the 1999 SMP included capping of contaminated sediments in coordination with projects proposed by the Washington State Department of Transportation (WSDOT) and the City of Seattle. Coordination will be pursued and the cleanup may be initiated as early as 2019 or following completion of the King St. RS CSO control project, depending on recontamination potential.
- **Denny Way RS Overflow/Elliott W Outfall:** The Denny Way CSO control project was completed in 2005, with the construction of the new Elliott W Wet Weather Treatment Station (WWTS) and a new offshore outfall. An interim remedial action was conducted under an Agreed Order (No. DE 5068) with Ecology and was completed in 2008. Approximately 14,000 cubic yards (cy) of sediment was dredged from nearshore areas in the immediate vicinity of the former Denny Way RS Overflow at the shoreline. The dredge area was backfilled and armored along the shoreline, with additional placement of clean sand around the perimeter of the dredge prism to address potential residuals that may have resulted from dredging. The site is currently undergoing long-term monitoring to meet Biological Opinion requirements of the Elliott West outfall construction and confirm the effectiveness of the remedial action. Sediments around the perimeter of a cap placed in 1990 offshore of the 2008 cleanup area still exceed the SMS and are being evaluated for additional cleanup actions by King County.

- **Hanford #2 and Lander St. RS Overflows:** The Hanford #2 and Lander St. RS overflows are located within the East Waterway CERCLA site. The 1999 SMP identified these areas for sediment removal and confined aquatic disposal as part of the Port of Seattle and U.S. Army Corps of Engineers (USACE) navigation improvement project. East Waterway sediments in the vicinity of the Hanford #2 RS Overflow and Lander St. RS Overflow have been removed as part of navigation improvement and berth deepening projects (phase 2 navigation channel deepening, T30 and T25 berth deepening). The Port of Seattle and EPA, in cooperation with King County and the City of Seattle, have completed a Remedial Investigation for the East Waterway, which characterized sediment adjacent to the two overflows. The group has developed a final Feasibility Study, which EPA will use to select a proposed cleanup plan for the East Waterway site. These parties are also in the process of undertaking source control actions in the drainage basin to reduce chemical inputs to the waterway. The 2012 LTCP Update identified a WWTS to control the Hanford #2 and Lander St. RS overflows.
- **Brandon Street Regulator Station Overflow:** The area adjacent to the Brandon St. RS Overflow was identified for action in the 1999 SMP. Capping was identified as the recommended remedial action over approximately 1 acre of contaminated sediments with a 1- to 3-foot sand capping layer. It was also identified as a low-priority cleanup site. The sediment was more recently characterized in the Lower Duwamish Remedial Investigation. Final remedial actions will be regulatorily managed under the LDW Superfund Site process, which is currently ongoing. The Brandon St. RS Overflow will be controlled by the Georgetown Wet Weather Treatment Station to reduce discharge to the Duwamish River. Outfall gate cleanout and additional source control investigations have occurred in the basin.
- **Chelan Ave. RS Overflow:** The 1999 SMP identified the Chelan Ave. RS Overflow discharge area for dredging and confined aquatic disposal and capping. It was also identified as a low-priority cleanup site. The Chelan Ave. RS Overflow is located within the Harbor Island Superfund Site and is within the West Waterway CERCLA site. Investigation and cleanup of West Waterway has been ongoing since the mid-1980s and a No Action Record of Decision (ROD; EPA 2003) was issued in September 2003 for West Waterway OU8 that includes the Chelan Ave. RS Overflow. The ROD presented the basis for the determination that no action was necessary to protect human health and the environment and that the site conditions allow for unlimited use and unrestricted

exposure. The fourth 5-year review report was completed in September 2015 (EPA 2015) and concluded that no additional evaluations are required at this time. Additional 5-year reviews of the site will be performed by EPA in the future, which could result in revisions to the cleanup decision if goals are not being met.

2.2.3 CSOs Evaluated in this SMP Update

A total of 25 CSO and two CSO treatment plant outfall discharge locations that are either a part of this sediment quality evaluation or are not already part of an existing cleanup are evaluated in this document (Table 2-2). Thirteen are located in marine environments of Puget Sound and Elliott Bay:

- Carkeek Outfall
- North Beach Pump Station Wet Well Overflow
- North Beach Pump Station Inlet Overflow
- South Magnolia Overflow
- 53rd Avenue Southwest Pump Station Overflow
- Alki Outfall
- 63rd Avenue SW Pump Station Overflow
- Southwest Alaska Street Overflow
- Murray Street Pump Station Overflow
- Barton Street Pump Station Overflow
- Kingdome Regulator Station Overflow
- Chelan Ave. RS Overflow
- Harbor Ave. RS Overflow

Note that Chelan is part of the original seven SMP sites discussed in Section 2.2.1. However, that site was selected as a representative CSO site to compare sediment and modeling results for model development presented in Appendix A.

Another 14 are located in freshwater environments of Lake Washington, the Lake Washington Ship Canal, Lake Union, and Portage Bay:

- Ballard Siphon Overflow
- 11th Avenue Northwest Overflow

- 3rd Avenue West Overflow
- Canal Street Overflow
- Dexter Avenue Regulator Station Overflow
- University RS Overflow
- Montlake Regulator Station Overflow
- Matthews Park PS Overflow
- Belvoir Pump Station Overflow
- 30th Avenue Northeast Overflow
- East Pine Street Pump Station Overflow
- Rainier Avenue Pump Station Overflow
- MLK Jr. Way Overflow
- Henderson Street Pump Station Overflow

2.3 Summary of CSO Receiving Sediment Modeling

The following sections summarize the CSO receiving sediment modeling for marine and freshwater CSOs, and estimate the signature chemical concentrations in CSO solids released at those locations. The County identified in the model development document (King County 2011) the purpose of the modeling including evaluation of potential sediment concentrations from releases, natural recovery estimations, and determination of need for a sediment impact zone. Modeling is used herein to:

1. Determine the potential for and the extent of predicted sediment SMS exceedances as one line of evidence used to determine sediment management strategy.
2. Characterize sediments under the Post-Construction Monitoring Plan (King County 2012b).
3. Provide the information needed to assess recontamination potential – an important component of cleanup evaluations.

2.3.1 Description of CSO Sediment Deposition Modeling

As described in Appendix A, two types of models were developed. The Environmental Fluid Dynamics Code (EFDC) model as configured provides detailed predictions of the deposition of particles associated with potential CSO discharges. The EFDC model was applied to a

Table 2-2
Summary of Model Results

CSO Number	CSO Discharge	Model Results				
		Type of Modeling Performed	Rationale for Model Selection	Maximum Outfall Deposition Rate (cm/year) [a]	Distance from Outfall With Deposition > 0.1 cm/year (feet) [b]	Does the Model Indicate Potential CSL Exceedances (Considering Diffuse Urban Inputs) [c]
Central Basin of Puget Sound						
046	Carkeek Outfall	Not modeled	Treated discharges only; no historical exceedances.	n/a	n/a	n/a
048a	North Beach PS WW Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.002	not exceeded	No
048b	North Beach PS Inlet Overflow	Not modeled	Intertidal beach flow could not be accurately modeled.	n/a	n/a	n/a
006	S Magnolia Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.018	not exceeded	No
052	53rd Ave. SW PS Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.0003	not exceeded	No
051	Alki Outfall	Not modeled	Treated discharges only; no historical exceedances.	n/a	n/a	n/a
054	63rd Ave. SW Overflow	Simple Model	Simple model considered sufficient for CSO with low discharge volumes and no historical exceedances.	0.001	not exceeded	No
055	SW Alaska St. Overflow	Simple Model	Simple model considered sufficient for CSO with no historical exceedances.	0.000006	not exceeded	No
056	Murray St. PS Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.007	not exceeded	No
057	Barton St. PS Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.01	not exceeded	No
Elliott Bay						
029	Kingdome RS Overflow	Simple Model	Simple model developed to evaluate CSO with relatively high annual discharge.	0.14	117	Yes for BEHP
West Waterway						
036	Chelan Ave. RS Overflow	EFDC Model	Site hydrodynamics considered too complex for the simple model.	0.012	not exceeded	No
037	Harbor Ave. RS Overflow	Simple Model	Simple model considered sufficient for CSO with no historical exceedances.	0.01	not exceeded	No

Table 2-2
Summary of Model Results

CSO Number	CSO Discharge	Model Results				
		Type of Modeling Performed	Rationale for Model Selection	Maximum Outfall Deposition Rate (cm/year) [a]	Distance from Outfall With Deposition > 0.1 cm/year (feet) [b]	Does the Model Indicate Potential CSL Exceedances (Considering Diffuse Urban Inputs) [c]
Lake Washington Ship Canal/Lake Union/Portage Bay						
003	Ballard Siphon Overflow	Simple Model	Simple model considered sufficient for CSO.	0.0023	not exceeded	No
004	11th Ave. NW Overflow	Simple Model	Simple model considered sufficient for CSO.	0.21	148	Yes for silver
008	3rd Ave. W Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.10	103	Yes for silver
007	Canal St. Overflow	Simple Model	Simple model considered sufficient for CSO.	0.0062	not exceeded	No
009	Dexter Ave. RS Overflow	Simple Model	Simple model considered sufficient for CSO.	0.49	171	Yes for silver
015	University RS Overflow	EFDC and Simple Model	Compare EFDC and simple models.	1.3	268	Yes for silver, di-n-octyl phthalate, and mercury
014	Montlake RS Overflow	EFDC and Simple Model	Compare EFDC and simple models.	0.52	174	Yes for silver

Table 2-2
Summary of Model Results

CSO Number	CSO Discharge	Model Results				
		Type of Modeling Performed	Rationale for Model Selection	Maximum Outfall Deposition Rate (cm/year) [a]	Distance from Outfall With Deposition > 0.1 cm/year (feet) [b]	Does the Model Indicate Potential CSL Exceedances (Considering Diffuse Urban Inputs) [c]
Lake Washington						
018	Matthews Park PS Overflow	Not modeled	CSO is controlled. No discharge frequency observed.	n/a	n/a	n/a
012	Belvoir PS Overflow	Simple Model	Co-located CSOs modeled as one discharge. Simple model considered sufficient for the location.	0.040	not exceeded	No
049	30th Ave. NE Overflow					
011	E Pine St. PS Overflow	Not modeled	CSO is controlled. No discharge frequency observed.	n/a	n/a	n/a
033	Rainier Ave. PS Overflow	Not modeled	CSO is controlled. No discharge frequency observed.	n/a	n/a	n/a
013	MLK Jr. Way Overflow	Not modeled	CSO is controlled. No discharge frequency observed.	n/a	n/a	n/a
045	Henderson St. PS Overflow	Not modeled	CSO is controlled. No discharge frequency observed.	n/a	n/a	n/a

Notes:

1. Table includes CSOs that are not part of an existing cleanup (see Table 1-1).

a. The maximum modeled deposition rate is based on the average deposition rate in model grid cells within 30 meter of the outfall. Additional model details are presented in Appendix A. For outfalls that were modeled with both models, deposition rates represent the maximum of the two models.

b. The distance from the outfall with deposition greater than 0.1 cm/ year is based on the distance where the curves in Figures 2-1 and 2-1 intersect the deposition threshold. This distance represents the maximum distance of a distance range where the average deposition is 0.1 cm/ year. For example, for Kingdom RS Overflow, the exceedance distance of 117 feet represents the average deposition for the model grid cells from 79 to 117 feet from the outfall.

c. Model indicated potential exceedances are based on the analysis in Appendix B (see Tables 6a and 8a). Note that exceedances consider elevated area-wide inputs and do not represent CSO inputs only.

BEHP = bis(2-ethylhexyl)phthalate
cm/year = centimeter per year
CSL = Cleanup Screening Level
CSO = combined sewer overflow
EFDC = Environmental Fluid Dynamics Code
MG/year = million gallons per year
n/a = not applicable
PCB = polychlorinated biphenyl
SCO = Sediment Cleanup Objective

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number of CSOs where King County had measured surface sediment chemistry in 2011. To verify the model's ability to predict sediment deposition patterns, the model results expressed as chemical concentrations in surface sediment were compared to the sample results at those CSOs. A simple model was also developed that could provide similar order-of-magnitude results as the EFDC, but could be run more simply and applied to sites where not all the detailed geophysical features and boundary condition information for EFDC had been collected. For several CSOs, both models were run to compare the results of each. All model runs were performed using the current discharge volumes and frequencies to predict current sediment deposition patterns.

Note that the models are intended for understanding the effects on receiving sediments over time and space; they do not provide precise predictions of deposition during CSO events, due to large variability in the timing and nature of CSO events and receiving water conditions. However, the results of Appendix A demonstrate that the models as applied appear to be conservative predictors of sediment contamination and are useful in determining if the discharges currently would create sediment contamination concerns. The simple model provides the more conservative estimates and could be considered a screening-type tool for determining if a discharge has any potential for creating sediment contamination at levels of concern. These models provide important information for interpreting sediment quality data and predicting long-term sedimentation patterns at the CSO locations. The model selection for each CSO is described in the following sections. Details of the development and application of the models are presented in Appendix A.

2.3.2 Marine Sediment

Of the 13 marine CSOs and CSO treatment plant outfalls retained for this analysis, ten are located within the central basin of Puget Sound, one within Elliott Bay, and two within the West Waterway (Table 2-2). The EFDC and simple models were both run for six CSOs with recent sediment quality data (North Beach PS WW Overflow, S Magnolia Overflow, 53rd Ave. SW PS Overflow, Murray St. PS Overflow, and Barton St. PS Overflow, and Chelan Ave. RS Overflow) to compare the results of the two models. The simple model also was run on five CSOs that were not targeted in the most recent sampling (North Beach PS Inlet Overflow, 63rd Ave. SW PS Overflow, SW Alaska St. Overflow, Kingdom RS Overflow, and

Harbor Ave. RS Overflow). No modeling was conducted on treated flows (Carkeek Outfall and Alki Outfall).

Figure 2-1 presents the predicted current deposition rates of CSO sediments with distance from the discharge location for all marine model runs. No CSOs had predicted deposition rates that exceed 1 centimeter per year (cm/year). Kingdome RS Overflow has predicted deposition rates exceeding 0.1 cm/year within 117 feet (36 meters) of the overflow.[3]

The other nine modeled CSOs (North Beach PS WW Overflow, S Magnolia Overflow, 53rd Ave. SW PS Overflow, 63rd Ave. SW PS Overflow, SW Alaska St. Overflow, Murray St. PS Overflow, Barton St. PS Overflow, Chelan Ave. RS Overflow, and Harbor Ave. RS Overflow) are not predicted to exceed 0.1 cm/year. Note that the model was determined to not be appropriate to be used at North Beach PS Inlet Overflow, as it discharges onto an intertidal flat.

In Puget Sound, currents tend to be an elliptical flow pattern from tides with the strongest current direction typically slightly offset from parallel to shore depending on the local topography and reversing direction during the tidal cycle. Therefore, the depositional pattern of marine CSOs is similar for all overflows and consists of areas of higher deposition offset from parallel to the shore in both directions from the overflows. Appendix A presents the depositional patterns of the CSOs based on EFDC modeling.

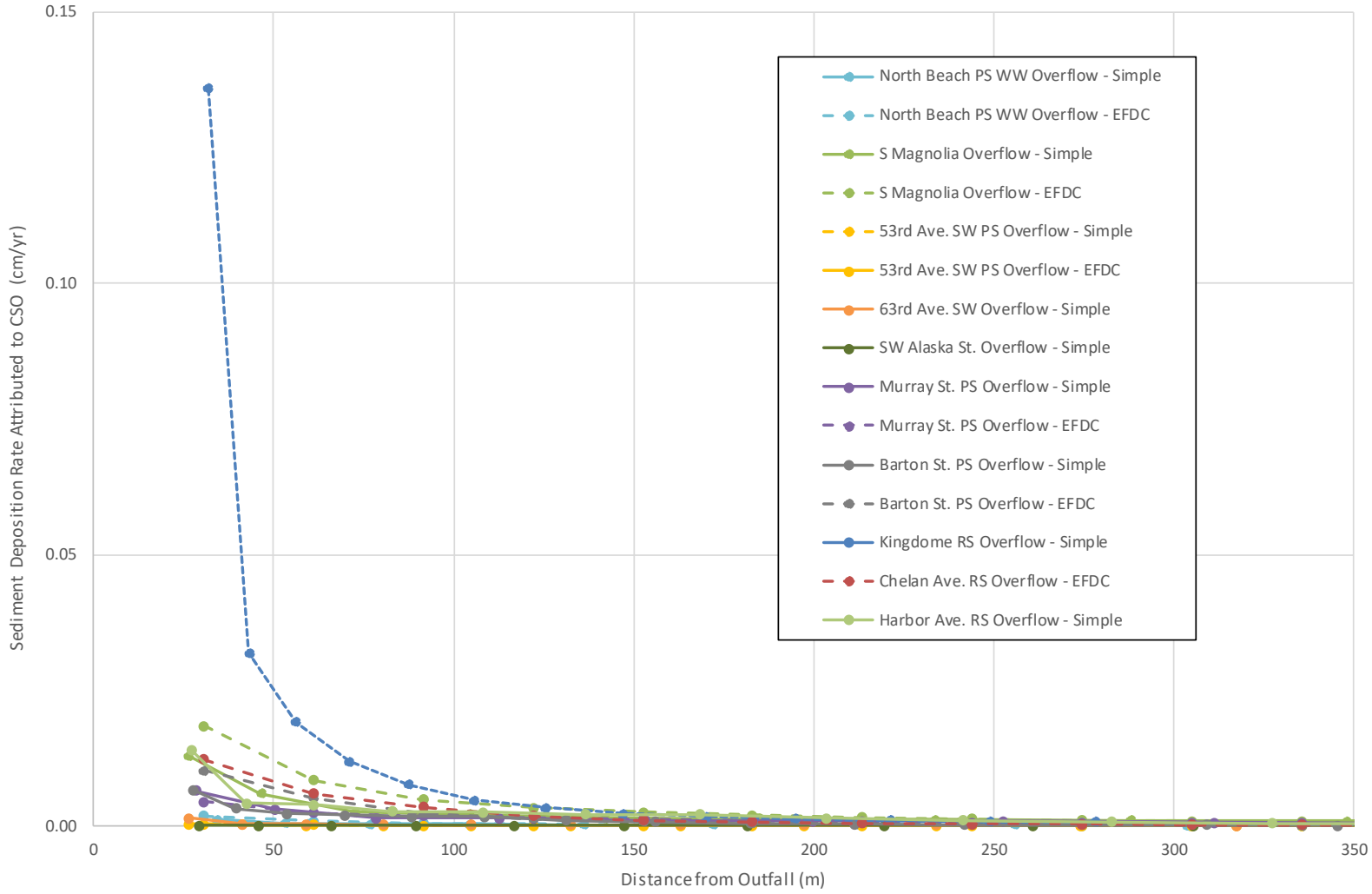
2.3.3 Freshwater Sediment

Of the 14 freshwater CSOs retained for SMP analysis, seven are located within the Lake Washington Ship Canal, Lake Union, and Portage Bay, and seven are located within Lake Washington.

In the Lake Washington Ship Canal, Lake Union, and Portage Bay, three CSOs (3rd Ave. W Overflow, University RS Overflow, and Montlake RS Overflow) were modeled with both the

[3] Note that the deposition rates represent the average deposition for model grid cells over each successive range of distances moving away from the outfall (see Figure 2-1 note). For example, at Kingdome, the average deposition rate exceeded 0.1 cm/year in the 79 to 117 feet band from the outfall. The exceedance area presented is based on the maximum distance that average deposition rate is predicted to exceed 0.1 cm/year (i.e., 117 ft).

Figure 2-1
Estimated CSO Sedimentation Rates for Marine CSOs



Note: the deposition rates represent the average deposition rate in model grid cells between the plotted distance and the next closest plotted distance. For example, a datapoint 30 m from the outfall represents the average deposition rate in model grid cells 0 m to 30 m from the outfall. If the next closest datapoint is 60 m from the outfall, then the datapoint 60 m from the outfall represents the average deposition rate in model grid cells 30 m to 60 m from the outfall.

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Figure 2-1
Estimated CSO Current Sedimentation Rates for Marine CSOs
King County Sediment Management Plan

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EFDC and the simple model to compare the results of the two models for CSOs with recent sediment quality data. Four other CSOs (11th Ave. NW Overflow, Ballard Siphon Regulator, Canal St. Overflow, and Dexter Ave. RS Overflow) were modeled with the simple model because they did not have recent sediment quality data. In Lake Washington, Belvoir PS Overflow and 30th Ave. NE Overflow were modeled as one discharge with the simple model, and the other overflows into Lake Washington were not modeled because they are all controlled and have no observed discharge frequency.

Figure 2-2 shows the deposition rates of CSO sediments with distance from the overflow for all model runs. The CSOs all have similar deposition patterns due to lack of tidal currents, with higher deposition rates closer to the overflow and deposition rates rapidly diminishing away from the overflow.

University RS Overflow is predicted to have the highest CSO deposition rates due to highest average annual flows. The CSO deposition rate is more than 1 cm/year within 119 feet (36 meters) from the overflow for the simple model (although the EFDC does not predict exceedances of 1 cm/year for the overflow). The CSO deposition rate is more than 0.1 cm/year within 265 feet (81 meters) from the overflow, based on both models.

Four other CSOs have predicted deposition rates between 0.1 cm/yr and 1 cm/yr. All four CSOs drop to less than 0.1 cm/year within up to 174 feet (53 meters) from the discharge location (11th Ave. NW Overflow, Dexter Ave. RS Overflow, 3rd Ave. W Overflow, and Montlake RS Overflow).

Ballard Siphon Overflow, Canal St. Overflow, Belvoir PS Overflow/30th Ave. NE Overflow do not exceed 0.1 cm/year at any distance from the discharge location, due to low annual CSO discharge rates.

2.3.4 CSO Solids Concentrations

As described in Appendix B, the available data from sediment trap and catch basin sampling within the combined sewer lines were analyzed to develop characteristic CSO solids concentration profiles to estimate the effects of the deposition of CSO solids in receiving

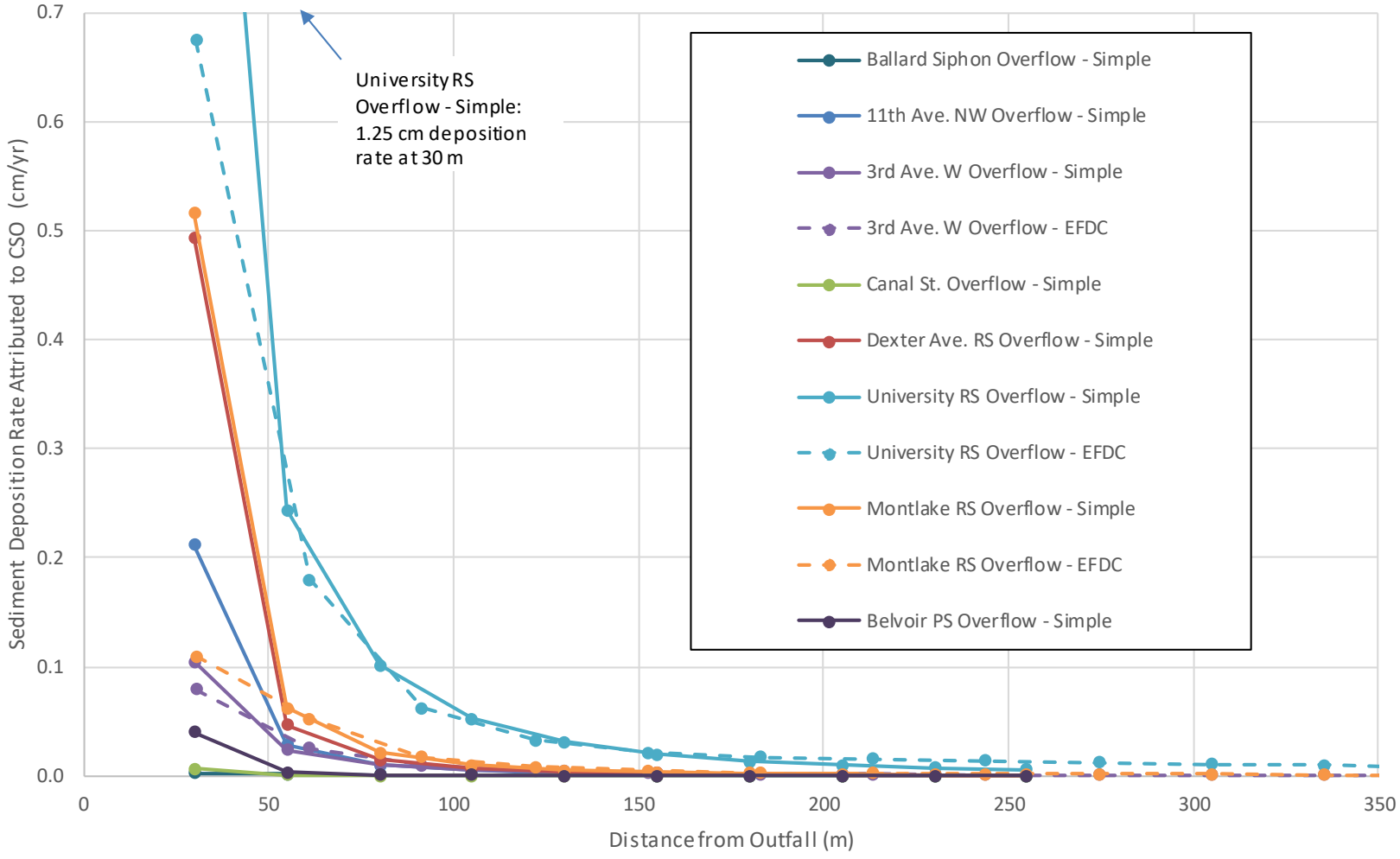
sediments. Due to temporal and spatial variation in chemical concentrations, the small number of samples from any single CSO basin, and the lack of data from many CSO basins, the data were combined into a single dataset to represent the range of expected concentrations of CSO particulates, rather than attempting to assign unique concentrations to each CSO. Two solids concentration profiles were developed: one representing the higher end of concentrations and one representing the lower end of concentrations to capture a range of potential CSO solids concentrations in King County CSOs. The two concentration profiles were established as a potential range of solids concentrations that could occur at any of the CSOs that have not been characterized; individual CSOs were not designated as higher concentration basins or lower concentration basins. Some chemicals exceed SMS criteria in

CSO solids (see Appendix B, Tables 1 and 2). Assuming the higher concentration profiles, the model predicts that the following 16 chemicals would exceed the SCO standard:

- Total polychlorinated biphenyls (PCBs) (marine [m] and freshwater [f])
- Total high-molecular-weight polycyclic aromatic hydrocarbons (HPAHs) (m)
- Total low-molecular-weight polycyclic aromatic hydrocarbons (LPAHs) (m)
- Total polycyclic aromatic hydrocarbons (PAHs) (f)
- Chysene (m)
- Fluoranthene (m)
- Phenanthrene (m)
- 1,4 dichlorobenzene (m)
- 4-methylphenol (p-cresol) (m and f)
- Bis(2-ethylhexyl)phthalate (BEHP) (m and f)
- Di-n-octyl phthalate (f)
- Mercury (m and f)
- Zinc (m)
- Silver (f)
- Nickel (f)
- Cadmium (f)

Assuming the lower concentration profile, the model predicts that the following six chemicals would exceed the SCO standard:

Figure 2-2
Estimated CSO Sedimentation Rates for Freshwater CSOs



Note: the deposition rates represent the average deposition rate in model grid cells between the plotted distance and the next closest plotted distance. For example, a datapoint 30 m from the outfall represents the average deposition rate in model grid cells 0 m to 30 m from the outfall. If the next closest datapoint is 60 m from the outfall, then the datapoint 60 m from the outfall represents the average deposition rate in model grid cells 30 m to 60 m from the outfall.

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Figure 2-2
Estimated CSO Current Sedimentation Rates for Freshwater CSOs
King County Sediment Management Plan

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- Total PCBs (m and f)
- 4-methylphenol (p-cresol) (m and f)
- BEHP (m and f)
- Silver (f)
- Nickel (f)

4-methylphenol (p-cresol) and 1,4-dichlorobenzene have high SMS exceedance factors in CSO solids; however, they tend to have transitory effects in sediment because of relatively fast degradation rates in aquatic environments and are not widely observed exceeding criteria in CSO receiving sediment samples. Although CSO solids concentrations would suggest widespread impacts to sediment, a review of sediment quality data in Appendix C shows 4-methylphenol (p-cresol) exceeds CSL criteria within 500 feet of CSOs at only one location (11th Ave NW Overflow), and 1,4, dichlorobenzene exceeds the CSL within 500 feet of CSOs at only one location (Chelan Ave. RS Overflow).

2.3.5 Threshold CSO Deposition Rates

Directly comparing CSO solids concentrations to SMS criteria does not account for ambient sedimentation, sediment mixing, or degradation. However, sediment quality near CSO discharge locations also reflects the effects of these processes. In particular, as CSO particulates settle near their discharge locations, they mix with other sources of sedimentation. For this analysis, the ambient sediment deposition rate was estimated for marine CSOs and for freshwater CSOs to estimate this mixing. The ambient sediment deposition rate was estimated to be 0.57 cm/year for marine discharge locations, and 0.3 cm/year for freshwater discharge locations, as shown in Appendix B, Section 5.

In addition, Appendix B presents a series of mass balance calculations to determine threshold CSO deposition rates that are more likely to result in exceedances of the CSL and therefore could result in a cluster of potential concern triggering the need for a hazard assessment and site identification per WAC 173-204-530. The analysis varies by chemical and is presented as a range of potential outcomes based on the range in CSO solids concentrations and ambient deposition concentrations (see Appendix B, Tables 6 and 7). Assuming the high range of CSO concentrations, the average ambient solids concentrations, and the maximum

model-predicted deposition rate (i.e., closest to the outfall), the model predicts CSL exceedances would occur at certain locations, as summarized in Table 2-2.

The results of Appendix B have been summarized for an order-of-magnitude understanding of the impact of CSO deposition. Based on the analysis in Appendix B, Section 6, 0.1 cm/year was estimated as the lower end CSO deposition rate where CSL exceedances could be present and trigger the need for a hazard assessment; 1 cm/year is the CSO deposition rate where CSL exceedances are more likely and SCO exceedances are probable.

2.4 Sediment Quality at CSO Discharge Locations

The following sections summarize the surface sediment quality at marine and freshwater CSOs. Direct sample measurements of sediment concentrations for SMS exceedances is another line of evidence used to determine sediment management strategy. Sediment sampling is one of the methods permitted under the Post Construction Monitoring Plan to characterize sediments.

Most King County CSOs have had multiple sediment sampling events from the late 1980s to the present. Sediment quality in these locations has been documented by King County in two main documents: the Comprehensive Sediment Quality Summary Report for CSO Discharge Locations (King County 2009) and CSO Sediment Quality Characterization Report (King County 2012c). In addition, sediment sampling data are available for select CSO discharge areas from sediment sampling events in 2013 and 2015. The need for sediment sampling has been determined by Ecology (Podger 2010). Other sediment data collected from previous investigations near each CSO discharge location were obtained from Ecology's Environmental Information Management database to provide supplemental data to evaluate sediment quality. All available existing sediment data are compiled in Appendix C.

All sediment data for both marine and freshwater environments are compared to benthic SMS criteria. These criteria are applied to surface sediment, defined as the 0 to 10 cm depth interval below the sediment surface. The results are compared to the SMS criteria to determine if a cluster of potential concern exists near any CSO. A cluster of potential concern as defined by WAC 173-204-510 requires a hazard assessment and site identification if a cleanup is needed (WAC 173-204-520). For CSOs that are identified as clusters of

potential concern, any additional nearby sources that may have contributed are also discussed. Where available, this evaluation focuses on the samples within 600 feet of the discharge locations and samples since 2005. Older samples are considered when new data are not available. The following sections provide a summary of existing sediment quality for CSO discharge locations for both marine and freshwater sediment environments.

2.4.1 Marine Sediment

Table 2-3 summarizes the surface sediment data for the 12 marine CSOs and CSO treatment plant outfalls included in this analysis. The complete dataset is presented in Appendix C.

2.4.1.1 Central Basin of Puget Sound

King County has ten CSOs discharge locations within the Central Basin of Puget Sound not including Inner Elliott Bay. Based on empirical data, none of these are considered to have a cluster of potential concern near the discharge. The ten areas are as follows (overflows located next to each other are combined for this analysis):

- **Carkeek Outfall:** Six surface sediment samples were collected by King County in 2000 to characterize sediment quality adjacent to the Carkeek Outfall. This characterization sampling was performed to supplement previous sediment sampling by King County in 1998 and 1996 in the vicinity. There were no chemical exceedances in the 2000, 1998, or the 1996 sampling events. A cluster of potential concern is not present at the site.
- **North Beach PS Overflow and North Beach PS Inlet Overflow:** Five and six surface sediment samples were collected by King County in 2013 and 2011, respectively, to characterize sediment quality adjacent to the North Beach PS Overflow as part of the nearfield model calibration effort. This characterization sampling was performed to supplement previous sediment sampling in 2001 and 1996 in the discharge area. There were no chemical exceedances in eleven samples analyzed in 2013 and 2011. Phenol exceeded the SCO criteria at one station in 1996; all phenol results were well below the SCO criteria in 2013 and 2011. The data indicate that a cluster of potential concern is not present at this site. No recent sediment sampling has been conducted near the North Beach PS Inlet Overflow, as this discharge was discovered to be at a separate location during the CSO control project after sampling was completed.

- **S Magnolia Overflow:** One surface sediment sample was collected in 2013 and six surface sediment samples were collected by King County in 2011 to characterize sediment quality adjacent to the S Magnolia Overflow as part of the nearfield model calibration effort. One additional surface sediment sample was collected in 2007 by Ecology as part of the Urban Waters Initiative sampling in Elliott Bay. There were no chemical exceedances in 2013, 2011, or 2007, indicating a cluster of potential concern is not present at this site.
- **53rd Ave. SW PS Overflow:** Six surface sediment samples were collected by King County in 2011 to characterize sediment quality adjacent to the 53rd Ave. SW PS Overflow as part of the nearfield model calibration effort. This characterization sampling was performed to supplement previous sediment sampling by King County in 1996 in the vicinity of the discharge area. There were no chemical exceedances in 2011 and 1996, indicating a cluster of potential concern is not present at this site.
- **Alki Outfall:** Six surface sediment samples were collected by King County in 2001 to characterize sediment quality adjacent to the Alki Outfall. This characterization sampling was performed to supplement previous sediment sampling by King County in 1999, 1997, and 1996 in the discharge area vicinity. There were no chemical exceedances in 2001 nor during the 1999, 1997, and 1996 sampling events. A cluster of potential concern is not present at this site.
- **63rd Ave. SW PS Overflow:** Six surface sediment samples were collected by King County in 1997 to characterize sediment quality adjacent to the 63rd Ave. SW PS Overflow. There were no chemical exceedances in 1997 so a cluster of potential concern was not present at this site.
- **SW Alaska St. Overflow:** Six surface sediment samples were collected by King County in 1997 to characterize sediment quality adjacent to the SW Alaska St. Overflow. There were no chemical exceedances in 1997 so a cluster of potential concern was not present at this site.
- **Murray St. PS Overflow: S**ix surface sediment samples were collected in 2013 and seven surface sediment samples were collected in 2011 by King County to characterize sediment quality adjacent to the Murray St. PS Overflow as part of the nearfield model calibration effort. This characterization sampling was performed to supplement previous sediment sampling by King County in 1997 in the discharge area. For the 2011 and 2013 sampling, several PAHs exceeded the SCO criteria in 2 of

Table 2-3
Summary of Existing Sediment Quality Data

General Characteristics		Existing Chemical Data (evaluated for samples within 600 feet of CSO outfall and sampled since 2005)		
CSO Number	CSO Discharge	Surface Sediments Exceed SMS SCO/LAET Ecological Risk Criteria?[a]	Surface Sediments Exceed SMS CSL/2LAET Ecological Risk Criteria?[a]	Is the Exceedance Area a SMS Station Cluster of Potential Concern?
Central Basin of Puget Sound				
046	Carkeek Outfall	No data within 600 feet since 2005 2000 data: No; 0 of 5 samples	No data within 600 feet since 2005 2000 data: No; 0 of 5 samples	No; no CSL exceedances
048a	North Beach PS WW Overflow	No; 0 out of 12 samples	No; 0 out of 12 samples	No; no CSL exceedances
048b	North Beach PS Inlet Overflow	No data within 600 feet	No data within 600 feet	No data within 600 feet
006	S Magnolia Overflow	No; 0 out of 8 samples	No; 0 out of 8 samples	No; no CSL exceedances
052	53rd Ave. SW PS Overflow	No; 0 out of 6 samples	No; 0 out of 6 samples	No; no CSL exceedances
051	Alki Outfall	No data within 600 feet since 2005 2001 data: No; 0 of 5 samples	No data within 600 feet since 2005 2001 data: No; 0 of 5 samples	No; no CSL exceedances
054	63rd Ave. SW Overflow	No data within 600 feet since 2005 1997 data: No; 0 of 5 samples	No data within 600 feet since 2005 1997 data: No; 0 of 5 samples	No; no CSL exceedances
055	SW Alaska St. Overflow	No data within 600 feet since 2005 1997 data: No; 0 of 5 samples	No data within 600 feet since 2005 1997 data: No; 0 of 5 samples	No; no CSL exceedances
056	Murray St. PS Overflow	Yes; 2 out of 13 sample locations; Butylbenzyl phthalate, Total Benzofluoranthenes (b,j,k), Total HPAH, Total LPAH, Chrysene, Acenaphthene, Phenanthrene, Dibenzofuran, Dibenzo(a,h)anthracene, Fluorene, Benzo(a)anthracene, Benzo(g,h,i)perylene, Ideno(1,2,3-c,d)pyrene, Fluoranthene, Benzo(a)pyrene	Yes; 1 out of 13 sample locations; Total Benzofluoranthenes(b,j,k), Phenanthrene	No; 2 CSL exceedance locations are isolated and bounded by other sample locations; there is no combination of three stations where the average exceeds the CSL for either chemical
057	Barton St. PS Overflow	Yes; 2016: 2 out of 13 samples; Butylbenzyl phthalate, chrysene, anthracene 2011: 6 out of 7 sample locations; PAHs, Phthalates, and other organics	Yes; 2016: 2 out of 13 samples; Butylbenzyl phthalate, chrysene 2011: 6 out of 7 sample locations; PAHs, Phthalates, and other organics	No; 2 CSL exceedances from 2016 are different chemicals and there is no combination of three stations where the average exceeds the CSL for either chemical 2016 sampling indicates sediments have recovered
Elliott Bay				
029	Kingdome RS Overflow	No: 0 out of 1 sample (2009) Location dredged in 2005	No: 0 out of 1 sample (2009) Location dredged in 2005	No; area was dredged in 2005 and existing post-dredging sample does not exceed CSL for any chemical
West Waterway				
036	Chelan Ave. RS Overflow	Yes; 5 out of 8 sample locations; Total PCB Aroclors, Butylbenzyl phthlate, Benzo(g,h,i)perylene, Chrysene, BEHP	Yes; 1 out of 8 sample locations; BEHP	Yes; cluster of potential concern for BEHP
037	Harbor Ave. RS Overflow	No data within 600 feet since 2005 1991/1992/1995 data: Yes; 6 of 7 sample locations: BEHP, butyl benzyl pthalate, cadmium, mercury, phenol, PCBs, PAHs	No data within 600 feet since 2005 1991/1992/1995 data: Yes; 6 of 7 sample locations: BEHP, butyl benzyl pthalate, cadmium, mercury, fluorene	Yes; historical cluster of potential concern for BEHP

Table 2-3
Summary of Existing Sediment Quality Data

General Characteristics		Existing Chemical Data (evaluated for samples within 600 feet of CSO outfall and sampled since 2005)		
CSO Number	CSO Discharge	Surface Sediments Exceed SMS SCO/LAET Ecological Risk Criteria?[a]	Surface Sediments Exceed SMS CSL/2LAET Ecological Risk Criteria?[a]	Is the Exceedance Area a SMS Station Cluster of Potential Concern?
Lake Washington Ship Canal/Lake Union/Portage Bay				
003	Ballard Siphon Overflow	Yes; 7 out of 7 sample locations; Arsenic, Cadmium, Copper, Mercury, Nickel, Silver, Total PCBs, Total PAH, BEHP, and Di-n-octyl phthalate	Yes; 1 out of 7 sample locations; Mercury, BEHP	Yes; cluster of potential concern for mercury
004	11th Ave. NW Overflow	Samples from early 2005 are elevated for PCBs and dioxins/furans but were not analyzed for other chemicals. Historical data had exceedances for metals, BEHP, 4-methylphenol, and total PCBs.	Historical data had exceedances for metals.	Yes; historical cluster of potential concern for cadmium and nickel
008	3rd Ave. W Overflow	Yes; 6 out of 7 sample locations; Mercury, Silver, Nickel, BEHP, Total PAH, Total PCB Aroclors, Di-n-butyl phthalate	Yes; 5 out of 7 sample locations; Mercury and Total PAH	Yes; cluster of potential concern for total PAHs
007	Canal St. Overflow	No data within 600 feet since 2005	No data within 600 feet since 2005	Likely; proximity to 3rd Avenue CSO indicates similar levels of contamination
009	Dexter Ave. RS Overflow	No data within 600 feet since 2005; historical (2001) SCO exceedance of metals, phthalates, PAHs, and PCBs near CSO outfall	No data within 600 feet since 2005; historical (2001) CSL exceedance of metals, phthalates, PAHs, and PCBs near CSO outfall	Yes; historical samples are a cluster of potential concern for multiple metals and organics
015	University RS Overflow	Yes; 9 out of 14 sample locations; Mercury, Silver, BEHP, Total PCB Aroclors, Nickel, Lead and Phenol	Yes; 3 out of 14 sample locations; Mercury, Silver and Total PCB Aroclors	Yes; cluster of potential concern for Mercury and PCBs
014	Montlake RS Overflow	Yes; 2 out of 7 sample locations; Lead and Arsenic	No; 0 of 7 samples.	No; no CSL exceedances
Lake Washington				
018	Matthews Park PS Overflow	No data within 600 feet since 2005	No data within 600 feet since 2005	No; no CSO-related exceedances expected because Mathews Park Pump Station is controlled
012/ 049	Belvoir PS Overflow and 30th Ave. NE Overflow	Yes; 1 out of 1 sample location; BEHP, total DDE 2005 sample was 50 ng/kg for dioxins/furans	No; 0 of 1 sample.	No; no CSL exceedances
011	E Pine St. PS Overflow	No data within 600 feet since 2005 2000 data: Yes; 2 out of 2 sample locations; nickel, BEHP	No data within 600 feet since 2005 2000 data: No; 0 out of 2 sample locations	No; no CSL exceedances
033	Rainier Ave. PS Overflow	No data within 600 feet since 2005 2000 data: Yes; 2 out of 2 sample locations; tributyltin tin, nickel, silver, BEHP, total PCBs, sulfide	No data within 600 feet since 2005 2000 data: No; 0 out of 2 sample locations	No; no CSL exceedances
013/ 045	MLK Jr. Way Overflow and Henderson St. PS Overflow	No data within 600 feet since 2005 Historical data (2000, 1995): Yes; 3 out of 3 sample locations; tributyltin, nickel, mercury, BEHP, total PAHs, total PCBs, dibenzofuran, dieldrin, sulfide	No data within 600 feet since 2005 Historical data (2000, 1995): Yes; 2 out of 3 sample locations; Mercury, total PAHs, Sulfide	Yes; historical data indicates a cluster of potential concern for total PAHs

Notes:
1. Table includes CSOs that are not part of an existing cleanup (see Table 1-1).
a. Chemicals are listed if they exceed at one or more sample locations.

2LAET = second lowest apparent effects threshold
BEHP = bis(2-ethylhexyl)phthalate
CSL = Cleanup Screening Level
CSO = combined sewer overflow
total DDE = total dichlorodiphenyldichloroethylene
HPAH = high-molecular-weight polycyclic aromatic hydrocarbon
LAET = lowest apparent effects threshold
LPAH = low-molecular-weight polycyclic aromatic hydrocarbon
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SCO = Sediment Cleanup Objective
SMS = Sediment Management Standards

13 sample locations. One location marginally exceeded the CSL for total benzofluoranthenes(b,j,k) and phenanthrene and exceeded the SCO for other PAHs. Sampling indicates that this is not a cluster of potential concern because the exceedance is isolated and there is no combination of three stations where the average exceeds the CSL for either chemical. The other exceedance location exceeded the SCO for butylbenzyl phthalate only.

- **Barton St. PS Overflow:** Thirteen surface sediment samples were collected by King County in 2016 to characterize sediment quality adjacent to the Barton St. PS Overflow. Six of the 13 samples were co-located with previous surface sediment samples collected by King County in 2011 as part of the nearfield model calibration effort. Another surface sediment sample was collected in 2007 by King County within 600 feet of the discharge location. The 2011 and 2007 sampling events had SCO and CSL exceedances in 6 of 7 samples for PAHs, phthalates, and other organics. However, the recent 2016 sampling event showed SCO and CSL exceedances in just 2 of 13 locations (for butylbenzyl phthalate, anthracene, and chrysene). Improvement of site conditions between the 2011 and 2016 sampling events indicates the location has recovered. CSL exceedances from 2016 are for different chemicals and there is no combination of three stations where the average exceeds the CSL for any chemical. A cluster of potential concern is not present at this site. There are adjacent CSO and stormwater outfalls, and nearby creosote-treated piling (Fauntleroy ferry terminal).

2.4.1.2 Elliott Bay

There is one CSO discharging within inner Elliott Bay included in this analysis:

- **Kingdome RS Overflow:** Sediments adjacent to the Kingdome RS (Terminal 46) were dredged in 2005 by the Port of Seattle. Dredged Material Management Program samples collected prior to dredging indicated exceedances of mercury, 1,4- dichlorobenzene, BEHP, 2,4,-dimethylphenol, and benzyl alcohol. However, nearby surface sediment sampling performed following dredging in 2009 for the East Waterway Superfund site results in no exceedances, indicating that the area has not recontaminated and is not a cluster of potential concern. In 1995 and 1996 (i.e., prior to the 2005 dredging event), surface sediment samples collected by King County had

SCO and CSL exceedances for PAHs, phthalates, total PCBs, and copper. The 1996 sampling event showed one SCO bioassay failure and two CSL bioassay failures. There are adjacent stormwater outfalls and creosote-treated pilings.

2.4.1.3 West Waterway

There are two CSOs within the West Waterway, as follows:

- **Chelan Ave. RS Overflow:** As described in Section 2.1, the Chelan Ave. RS Overflow is located within but near the edge of the West Waterway Operable Unit of the Harbor Island Superfund Site. EPA issued a no further action decision for this portion of the West Waterway Operable Unit in 2003. This status is reassessed in 5-year review cycles. Sediment sampling at the Chelan Ave. RS Overflow was performed in 2011 (six samples) and in 2013 (two samples) by King County as part of the nearfield model calibration effort. Five of eight samples exceeded the SCO for total PCBs, phthalates, and PAHs, and one of eight samples exceeded the CSL for BEHP. Although there was only one CSL exceedance, this area is a cluster of potential concern for BEHP because the average of three sample points, including the maximum BEHP exceedance, exceeds the CSL (sample CH-6 has a concentration of 407 milligrams per kilogram (mg/kg) or organic carbon (OC), more than three times the CSL concentration of 78 mg/kg OC). Nearby stormwater outfalls and piling (Terminal 7C) may contribute to the cluster of potential concern.
- **Harbor Ave. RS Overflow:** The Harbor Ave. RS Overflow is located within the WW-OU08 within the Harbor Island Superfund Site. EPA issued a no further action decision for this portion of the West Waterway Operable Unit in 2003. This status is reassessed in 5-year review cycles; therefore, no sediment data have been collected recently. Data from the early 1990s indicate that the area was a cluster of potential concern for BEHP at that time. A CSO and Longfellow Creek both discharge out the same pipe as the Harbor Ave. RS Overflow.

2.4.2 Freshwater Sediment

Table 2-3 summarizes the surface sediment data for the 12 freshwater CSOs included in this analysis. The complete dataset is presented in Appendix C.

2.4.2.1 Ship Canal/Lake Union/Portage Bay

King County has seven CSOs discharging within the Ship Canal/Lake Union/Portage Bay. Based on empirical data, receiving sediments associated with six CSOs would be considered to have (or likely to have) a cluster of potential concern near the discharge, and one CSO is not considered a cluster of potential concern. However, most discharge locations are in highly developed areas with multiple nearby sources, and there are general widespread elevated concentrations of several chemicals across much of this area. The seven areas are as follows:

- **Ballard Siphon Overflow:** Seven surface sediment samples were collected by King County in 2015 for CSO control post-construction monitoring. All seven locations exceeded the SCO, with one or more exceedances for metals (arsenic, cadmium, copper, mercury, nickel, and silver), total PCBs, total PAHs, BEHP, and di-n-octyl phthalate. One location exceeded the CSL (for mercury and BEHP). Although only one location exceeded the CSL, there is a cluster of potential concern because the magnitude of the exceedance for mercury results in an exceedance of the CSL in three samples averaged together. Surface sediment chemistry results from historical studies throughout this area indicated chemical exceedances for metals, phthalates, PAHs, total PCBs, and other organics (see Appendix C). There are adjacent stormwater outfalls and industrial activity in the Ship Canal.
- **11th Ave. NW Overflow:** Two surface sediment samples were collected in 2005 adjacent to the 11th Ave. NW Overflow discharge area as part of the LDW Phase 2 investigation and tested for PCBs, pentachlorophenol, and dioxin/furans. The SCO was exceeded for total PCBs only, and no exceedances of the CSL were measured. Historical samples were collected within 600 feet of the overflow in 1989, 1990, 1995, 1996, and 1997. The historical samples 20 years old and older consistently exceeded the SCO or CSL for metals, BEHP, 4-methylphenol, and total PCBs, and represent a cluster of potential concern for cadmium and nickel. There are adjacent stormwater outfalls and industrial activity in the Ship Canal.
- **3rd Ave. W Overflow:** Seven surface sediment samples were collected by King County in 2011 to characterize sediment quality adjacent to the 3rd Ave. West Overflow as part of the nearfield model calibration effort. Surface sediment chemistry results exceeded both the SCO and CSL criteria. The SCO was exceeded in six of seven locations for metals (nickel, mercury, and silver), total PCBs, phthalates, and PAHs.

The CSL was exceeded in five of seven locations for mercury and total PAHs, and sediments are a cluster of potential concern for total PAHs, based on the average concentrations in the three samples nearest to the overflow. There are adjacent CSOs and stormwater outfalls and ship activity in the Ship Canal.

- **Canal St. Overflow**: Canal St. Overflow is located 520 feet east of the 3rd Ave. W Overflow and across the Ship Canal. Sediment quality has not been evaluated in the past 10 years and historical data throughout this area indicated chemical exceedances for metals, phthalates, PAHs, total PCBs, and other organics. There are adjacent CSOs, stormwater outfalls, and ship activity in the Ship Canal.
- **Dexter Ave. RS Overflow:** Sampling was performed in two locations in 2001 by King County to characterize sediment quality adjacent to the Dexter Ave. RS overflow. Three replicates were analyzed at each location. In addition, one surface sediment sample was collected by King County in 1989. Surface sediment chemistry results from the 2001 sampling event adjacent to the Dexter Ave. RS overflow discharge area had exceedances of both the SCO and CSL criteria. SCO exceedances from 2001 included arsenic, nickel, and BEHP; CSL exceedances included metals (cadmium, chromium, copper, lead, mercury, and silver), tributyltin (TBT), total PCBs, total PAHs and other organics. Surface sediment chemistry results from 1989 exceeded the CSL for total PAHs, di-n-butyl phthalate and dibenzofuran, the sample was not analyzed for metals. Based on this information, the sediment is a historical cluster of potential concern for multiple chemicals. A stormdrain discharges out the same pipe as the Dexter Ave. RS Overflow, and there are adjacent stormwater outfalls and industrial activity in Lake Union.
- **University RS Overflow:** Recent sediment sampling was conducted by King County in 2011 (eight surface sediment samples) and in 2013 (five surface sediment samples and two core samples) as part of the nearfield model calibration effort. Nine of 14 samples exceeded the SCO, with exceedances for total PCBs, mercury, silver, nickel, lead, and phenol. Three out of 14 samples exceeded the CSL with exceedances for total PCBs, mercury, and silver. A cluster of potential concern is present at the site for mercury and PCBs. A stormwater basin discharges out the same pipe as the University RS Overflow, and there are other nearby stormwater outfalls, and vessel activities.
- **Montlake RS Overflow:** Seven surface sediment samples were collected by King County in 2011 to characterize sediment quality adjacent to the Montlake RS

Overflow as part of the nearfield model calibration effort. Surface sediment chemistry results had one SCO exceedance for lead and one SCO exceedance for arsenic isolated at different sample locations. There were no CSL exceedances. A cluster of potential concern is not present at this site.

2.4.2.2 Lake Washington

King County has seven CSOs discharging within Lake Washington. There is little empirical data at these sites since 2005 because these CSOs are controlled. The seven areas are as follows overflows located next to each other are combined for this analysis:

- **Matthews Park Pump Station Overflow:** The Matthews Park PS overflow is controlled and has averaged less than one overflow event per year since 1991. Because the CSO has long been controlled, King County has not sampled Lake Washington sediments near the Matthews Park PS CSO discharge point.
- **Belvoir PS Overflow and 30th Ave. NE Pump Station Overflow:** The Belvoir PS Overflow in uncontrolled and the 30th Ave. NE PS overflow is controlled. One surface sediment sample (0 to 10 cm) adjacent to the overflow in 2013 was collected as part of the nearfield model calibration effort because this was the largest Lake Washington discharge. One additional sample was collected in 2005 adjacent to the overflow discharge area as part of the LDW Phase 2 investigation and tested for PCBs, pentachlorophenol, and dioxin/furans. Surface sediment chemistry results from the 2013 sediment sampling exceeded the SCO for BEHP and total 1,1-Dichloro-2,2-bis(p-chlorophenyl) ethylene (DDE). There were no CSL exceedances. The 2005 LDW Phase 2 sampling showed no exceedances, although dioxins/furans were elevated (50 nanograms per kilogram). A cluster of potential concern is not present at the site.
- **East Pine St. PS Overflow:** The East Pine St. PS Overflow is controlled and has averaged less than one overflow event per year since 1991. King County collected two surface sediment samples adjacent to the East Pine St. PS Overflow in 2000 to characterize sediment quality. Surface sediment chemistry results exceeded the SCO for nickel (both locations), BEHP (one of two locations), and sulphide (one of two locations) and did not exceed the CSL for any chemical. A cluster of potential concern is not present at the site.

- **Rainier Ave. PS Overflow:** The Rainier Ave. PS Overflow is controlled and has no recorded overflow events since 1991. King County collected two surface sediment samples adjacent to the Rainier Ave. PS Overflow in 2000 to characterize sediment quality. Surface sediment chemistry results from the 2000 sediment sampling event exceeded the SCO for nickel, silver, TBT, total PCBs, BEHP, and sulfide at one or two locations depending on the chemical. The CSL was not exceeded. A cluster of potential concern is not present at the site.
- **MLK Jr. Way Overflow and Henderson St. PS Overflow:** The MLK Jr. Way Overflow/Henderson St. PS Overflow is controlled and has no recorded overflow events since 1991. King County collected two surface sediment samples adjacent to the overflow in 2000 to characterize sediment quality. Both locations exceed the SCO with one or more chemicals for nickel, mercury, TBT, total PCBs, PAHs, dibenzofuran, dieldrin, sulfide, and BEHP. One location exceeds CSL with exceedances for total PAHs and sulfide. A sample collected in 1995 had exceedances of the SCO for BEHP, dibenzofuran, and dieldrin and exceeds the CSL for total PAHs. Based on these three historical locations, a cluster of potential concern was present for total PAHs. A stormwater basin shares the same outfall as the MLK Jr. Way Overflow/Henderson St. PS Overflow.

2.5 Sediment Management Strategy

This section synthesizes the preceding information for the CSO and CSO treatment plant outfall sites presented in Sections 2.1 through 2.4 (and existing information for the remaining CSO and CSO treatment plant outfall sites) as lines of evidence to identify the needed sediment management strategy for each King County CSO. Table 2-4 summarizes the lines of evidence for each site. These include the following:

- Existing sediment cleanup actions occurring near the CSO discharge location
- CSO control status
- Model predicted CSO solids deposition near the CSO discharge location
- Sediment concentrations near the CSO discharge location
- Potential contributing sources

Table 2-4
SMP Site Strategy

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observed Sediment Concentrations	Sediment Management Strategy
Central Basin of Puget Sound								
046	Carkeek Outfall	No	Treated	n/a	No; no CSL exceedances	None	No	No Further Action
048a	North Beach PS WW Overflow	No	Controlled	No	No; no CSL exceedances	None	No	No Further Action
048b	North Beach PS Inlet Overflow	No	Controlled	n/a	No data within 600 feet	None	No	Additional Evaluation
006	S Magnolia Overflow	No	Uncontrolled	No	No; no CSL exceedances	Other CSO, stormwater outfalls, marina activities	No	No Further Action
052	53rd Ave. SW PS Overflow	No	Controlled	No	No; no CSL exceedances	Not evaluated - no exceedances	No	No Further Action
051	Alki Outfall	No	Treated	n/a	No; no CSL exceedances	63rd Ave Pump Station CSO (KC054), stormwater outfalls	No	No Further Action
054	63rd Ave. SW Overflow	No	Controlled	No	No; no CSL exceedances	Alki CSO Treatment Plant (KC051), stormwater outfalls	No	No Further Action
055	SW Alaska St. Overflow	No	Controlled	No	No; no CSL exceedances	None	No	No Further Action
056	Murray St. PS Overflow	No	Uncontrolled	No	No; 2 CSL exceedance locations are isolated and bounded by other sample locations; there is no combination of three stations where the average exceeds the CSL for either chemical	Adjacent CSO stormdrain	Isolated exceedance could be attributable to City SD or County CSO	No Further Action
057	Barton St. PS Overflow	No	Uncontrolled	No	No; 2 CSL exceedances from 2016 are different chemicals and there is no combination of three stations where the average exceeds the CSL for either chemical 2016 sampling indicates sediments have recovered	Adjacent CSO stormdrain and creosote piling (ferry terminal)	Yes	Additional Evaluation
Elliott Bay								
027a	Denny Way RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
027b	Elliott West Outfall	Yes	Treated	n/a	n/a	n/a	n/a	Part of Existing Cleanup
028	King St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
029	Kingdome RS Overflow	No	Uncontrolled	Yes for BEHP	No; area was dredged in 2005 and existing post-dredging sample does not exceed CSL for any chemical	Adjacent stormwater outfalls and creosote piling	Yes	Additional Evaluation
East and West Waterway								
030	Lander St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
032	Hanford #2 RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
036	Chelan Ave. RS Overflow	Yes; at site boundary	Uncontrolled	No	Yes; cluster of potential concern for BEHP	Nearby stormwater outfall and piling	Yes	Additional Evaluation
037	Harbor Ave. RS Overflow	Yes; at site boundary	Uncontrolled	No	Yes; historical cluster of potential concern for BEHP	Nearby CSO and Longfellow Creek discharge out the same outfall.	Yes	No Further Action (under existing cleanup)

Table 2-4
SMP Site Strategy

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observed Sediment Concentrations	Sediment Management Strategy
Lake Washington Ship Canal/Lake Union/Portage Bay								
003	Ballard Siphon Overflow	No	Controlled	No	Yes; cluster of potential concern for mercury	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	Evaluate as Part of Area-wide Investigation
004	11th Ave. NW Overflow	No	Uncontrolled	Yes for silver	Yes; historical cluster of potential concern for cadmium and nickel	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	Evaluate as Part of Area-wide Investigation
008	3rd Ave. W Overflow	No	Uncontrolled	Yes for silver	Yes; cluster of potential concern for total PAHs	3rd Ave., Canal Street and Other CSO are proximal to each other. Adjacent stormwater outfalls and ship activity in the ship canal.	Yes	Evaluate as Part of Area-wide Investigation
007	Canal St. Overflow	No	Controlled	No	Likely; proximity to 3rd Avenue CSO indicates similar levels of contamination	3th Ave., Canal Street and Other CSO are proximal to each other. Adjacent stormwater outfalls and ship activity in the ship canal.	Yes	Evaluate as Part of Area-wide Investigation
009	Dexter Ave. RS Overflow	No	Controlled	Yes for silver	Yes; historical samples are a cluster of potential concern for multiple metals and organics	A stormwater basin shares the discharge pipe. Adjacent stormwater outfalls and industrial activity in Lake Union.	Yes	Evaluate as Part of Area-wide Investigation
015	University RS Overflow	No	Uncontrolled	Yes for silver, di-n-octyl phthalate, and mercury	Yes; cluster of potential concern for Mercury and PCBs	A stormwater basin shares the outfall. Nearby UW stormwater outfalls and University vessel activities.	Yes	Evaluated Cleanup in this SMP Update
014	Montlake RS Overflow	No	Uncontrolled	Yes for silver	No; no CSL exceedances	Adjacent stormwater outfalls and industrial activity in the ship canal	Yes	No Further Action
Lake Washington								
018	Matthews Park PS Overflow	No	Controlled	n/a	No; no CSO-related exceedances expected because Mathews Park Pump Station is controlled	Ambient North Lake Washington conditions	No data	No Further Action
012/ 049	Belvoir PS Overflow and 30th Ave. NE Overflow	No	Uncontrolled and Controlled respectively	No	No; no CSL exceedances	Other CSO	Yes	No Further Action
011	E Pine St. PS Overflow	No	Controlled	n/a	No; no CSL exceedances	Two other CSOs	Yes; no recorded King County CSO events	No Further Action
033	Rainier Ave. PS Overflow	No	Controlled	n/a	No; no CSL exceedances	Other CSO, stormwater outfalls and shoreline activities	Yes; no recorded King County CSO events	No Further Action
013/ 045	MLK Jr. Way Overflow and Henderson St. PS Overflow	No	Controlled	n/a	Yes; historical data indicates a cluster of potential concern for total PAHs	A stormwater basin shares the outfall. Nearby CSO, stormwater outfalls, and shoreline activities	Yes; no recorded King County CSO events	Additional Evaluation

Table 2-4
SMP Site Strategy

CSO Number	CSO Name	Within the Boundary of an Existing Sediment Cleanup Site?	CSO Control Status	Does the Model Predict Possible CSL Exceedances (Considering Diffuse Urban Inputs)?	Cluster of Potential Concern?	Nearby Pathway or Potential Sources	Other Inputs Needed to Account for Observed Sediment Concentrations	Sediment Management Strategy
Duwamish River								
031	Hanford #1 Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
034	E Duwamish PS Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
035	W Duwamish Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
043	E Marginal Way PS Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
039	S Michigan St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
041	Brandon St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
044	Norfolk St. Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
037	Henderson / MLK Outfall	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
038	Terminal 115 Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
042	W Michigan St. RS Overflow	Yes	Uncontrolled	n/a	n/a	n/a	n/a	Part of Existing Cleanup
040	8th Ave. S Overflow	Yes	Controlled	n/a	n/a	n/a	n/a	Part of Existing Cleanup

Notes:
BEHP = bis(2-ethylhexyl)phthalate
cm/year = centimeters per year
CSL = Cleanup Screening Level
CSO = combined sewer overflow
n/a = not applicable; not evaluated for the CSO
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SD = storm drain
SMP = Sediment Management Plan
UW = University of Washington

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Based on all lines of evidence, a strategy for managing sediment for each CSO is identified. Identified strategies for CSOs fall into five groups, as follows:

1. **Sediments are evaluated as part of an existing cleanup process**
   This is applicable to CSOs that discharge into areas designated as cleanup sites under CERCLA or MTCA. The CSOs being cleaned up under the original SMP are also included in this list.
2. **No action**
   This is applicable to CSOs that do not have a cluster of potential concern. These CSOs will continue to be subject to monitoring under the NPDES permit and, if applicable, the Post-Construction Monitoring Plan (King County 2012b).
3. **Additional monitoring**
   This is applicable to CSOs that lack recent sediment quality data, where historical data had a cluster of potential concern and recovery appears possible with control, or where the modeling predicts the potential for exceedances but existing sediment data does not. Although sediment quality has been characterized at these sites (with one exception), they warrant monitoring to determine if any exceedances will occur in the future, or is occurring now, are persistent, and associated with the CSO.
4. **Further evaluate in the context of area-wide investigation (not evaluated at this time)**
   This is applicable to CSOs that have a cluster of potential concern, but concentrations of those or other chemicals are elevated throughout the area and multiple pathways and potential sources are nearby.
5. **Further evaluate in this SMP update**
   This is applicable to CSOs that have a cluster of potential concern or where modeling predicts clear exceedances in an area where a site can be defined.

The following sections summarize the CSOs that are part of the five groups.

2.5.1 CSOs Already Being Addressed Under an Existing Cleanup Process

Fourteen CSOs and two CSO treatment plant outfalls are being addressed as part of an existing cleanup or through the original SMP. These are primarily CSOs located in the Duwamish, East, and West waterways or the Elliott Bay waterfront. Eleven of these are within the LDW, as follows:

- Hanford #1 Overflow
- Duwamish PS Overflow
- W Duwamish Overflow
- Brandon St. RS Overflow
- Terminal 115 Overflow
- S Michigan St. RS Overflow
- W Michigan St. RS Overflow
- E Marginal Way PS Overflow
- 8th Ave. S Overflow
- Norfolk St. Overflow
- Henderson/ MLK Outfall

Two of these are within the East Waterway Superfund site:

- Hanford #2 RS Overflow
- Lander St. RS Overflow

Three of these are along the Seattle Waterfront:

- King St. RS Overflow
- Denny Way RS Overflow
- Elliott West Outfall

Note that the Harbor Ave. RS Overflow and Chelan Ave. RS Overflow are located in the West Waterway Superfund site, but are evaluated in this update because that unit has already completed its cleanup decision and no cleanup was required in those locations.

2.5.2 CSOs Identified for No Further Action

Fourteen CSOs and two CSO treatment plant outfalls were identified as needing no further action. These are primarily CSOs located in the central basin of Puget Sound and Lake Washington. All of these sites comply with the SMS. Twelve of these are controlled or discharging treated flows:

- Carkeek Outfall
- North Beach PS WW Overflow

- North Beach PS Inlet Overflow
- 53rd Ave. SW PS Overflow
- Alki Outfall
- 63rd Ave. SW Overflow
- SW Alaska St. Overflow
- Harbor Ave. RS Overflow
- Matthews Park PS Overflow
- 30th Ave. NE Overflow
- E Pine St. PS Overflow
- Rainier Ave. PS Overflow

Four of these are uncontrolled but do not have sediment impacts above the regulatory standards at current flows:

- **S Magnolia Overflow:** Modeling indicated the overflow is not a cluster of potential concern. Sampling in 2011 and 2013 resulted in no SCO or CSL exceedances.
- **Murray St. PS Overflow:** Modeling and sampling from 2011 and 2013 indicate the location is not a cluster of potential concern.
- **Montlake RS Overflow:** Modeling indicated a possible cluster of potential concern for silver (both the EFDC and the simple model); however, sampling in 2011 resulted in no CSL exceedances.
- **Belvoir PS Overflow:** Modeling and sampling indicate the location is not a cluster of concern. This location shares an outfall with 30th Ave. NE Overflow.

All CSOs will be routinely monitored as part of the King County CSO NPDES permit. This monitoring includes a requirement at completion of control, to demonstrate compliance with the SMS through the Post-Construction Monitoring Plan (King County 2012b).

2.5.3 CSOs Identified for Additional Monitoring

Six CSOs, listed below, are identified as needing additional evaluations (e.g., additional sampling or modeling) to determine if these sites could generate SMS exceedances that would require a hazard assessment and cleanup site identification, if needed. None of these sites appears to require immediate actions.

- **North Beach PS Inlet Overflow** has already been controlled in 2015, but this intertidal second overflow location at North Beach PS was not sampled and modeling was determined to not be appropriate for these site conditions. Post-construction monitoring will occur, with results submitted to Ecology.
- **Barton St. PS Overflow** was identified for additional monitoring due to elevated concentrations observed in 2011 and to determine if recovery observed in the 2016 post-construction monitoring will remain.
- **Kingdome RS Overflow** had previous exceedances in the 1990s but the area has been dredged for slip maintenance. Modeling predicts potential for exceedances although recent sampling does not indicate any. Post-construction monitoring will occur once this CSO is controlled.
- **Chelan Ave. RS Overflow** has been identified as a cluster of potential concern for BEHP, based on sediment sampling. Modeling does not predict exceedances attributable to CSO releases alone and other pathways and potential sources are nearby. Chelan Ave. is within but near the boundary of the West Waterway Operable Unit, which EPA issued a No Action decision for in 2003. The fourth 5-year review report was completed in September 2015 (EPA 2015) and concluded that no additional evaluations are required at this time. However, post-construction monitoring will occur once the CSO is controlled.
- **MLK Jr. Way Overflow and Henderson St. PS Overflow (two co-located overflows)** have not been sampled since 2000, but was a cluster of concern for PAHs at that time. There are no CSO events on record (since 1991) and other pathways and potential sources are nearby. Further evaluation may be warranted.

2.5.4 CSOs Identified for Further Evaluation in the Context of Area-wide Investigation

Five CSOs are located in highly developed areas with impacted sediments from multiple potential sources. Due to multiple pathways and potential sources nearby and widespread contamination, these CSOs are identified for further evaluation when an area-wide investigation is conducted. Attempting any cleanup in these areas unilaterally would likely result in recontamination from adjacent sediments and ongoing sources. All five CSOs are

located in Lake Washington Ship Canal/Lake Union. Ballard Siphon and Canal St. Overflows are controlled, and the rest of the CSOs are uncontrolled. The CSOs are the following:

- Ballard Siphon Overflow
- 11th Ave. NW Overflow
- 3rd Ave. W Overflow
- Canal St. Overflow
- Dexter Ave. RS Overflow

Ballard Siphon Regulator and 3rd Ave. W Overflows have recent sediment quality data, and the other three CSOs will require additional sediment evaluations when an area-wide investigation is conducted. Modeling indicates that CSO discharges from Dexter, 3rd Ave. W, and 11th Ave. NW Overflow could potentially result in a cluster of potential concern for silver. CSO discharges from Canal St. and Ballard Siphon CSOs are unlikely to result in a cluster of potential concern.

2.5.5 CSOs Identified for Further Evaluation

University RS Overflow was identified as a cluster of potential concern from recent sampling and has been identified for further evaluation in the SMP update. The lines of evidence suggest that a hazard assessment is needed and identification of a cleanup site is likely per WAC 173-204-530. The CSO is uncontrolled and influenced by adjacent pathways and potential sources. However, there is an area of elevated concentrations that suggests a site can be clearly defined, and the County anticipates that cleanup will be required at this location.

3 SEDIMENT CLEANUP EVALUATION

As described in Section 2, the lines of evidence suggest that a hazard assessment is needed, and identification of a cleanup site is likely at University RS Overflow. This is in addition to the seven SMP sites identified for cleanup in the 1999 SMP, and CSOs located in existing Superfund sites. To understand the potential cost implications of any cleanup required at this site for long-range planning, University RS Overflow has been identified for evaluation of cleanup alternatives. The evaluation, detailed in Appendix E, describes the site and develops and compares cleanup alternatives. The purpose of this evaluation is to provide a planning-level analysis and costs for decision making on how King County will likely be required to move forward to address sediments at this location. It is anticipated that this evaluation will be used to support the future development of a cleanup action plan (CAP) consistent with WAC 173-204-575.

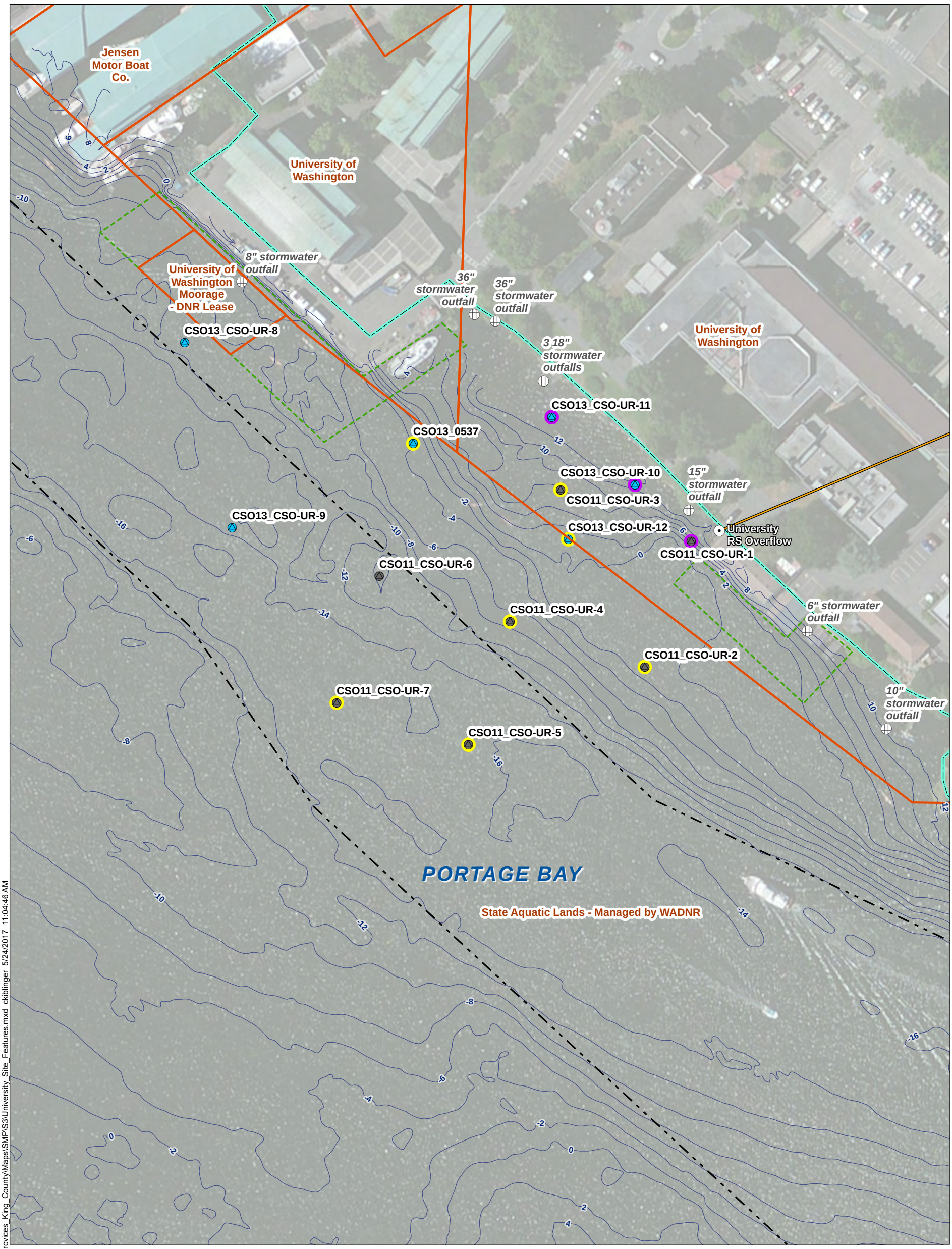
3.1 Site Description

University RS Overflow (NPDES Discharge Serial Number 015) was originally a City of Seattle CSO on the North Trunk; Metro (now King County) assumed operation of the North Trunk in 1962. The regulator was built by Metro in 1976.

The overflow is to surface water in Portage Bay through the seawall on the south side of the UW campus in Seattle (Figure 3-1). Bathymetric elevations in the proposed site unit range from +12 feet North American Vertical Datum 88 (NAVD88) or greater near the seawall to -16 feet NAVD88 in the navigation channel. The water depth at this site ranges from 4 to 35 feet throughout the site unit, based on the elevation of the lake (controlled by USACE from 16.6 to 18.6 feet NAVD88 or 20 to 22 feet USACE datum). Additional details presented in Appendix E describe the CSO control status, site uses, and receiving sediment conditions.

3.2 Cleanup Evaluation

The evaluation detailed in Appendix E generally meets the requirements for a remedial investigation/feasibility study for a simple site, as described in Section 2.4 of the Sediment Cleanup Users Manual (Ecology 2015). A Sediment Cleanup Unit is established, and the site-specific cleanup standards and ARARs are defined. Using remedial technologies applied to



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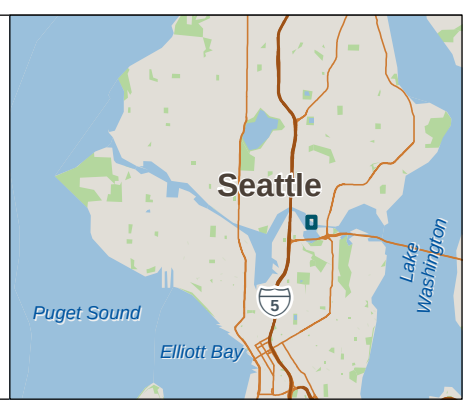
Sediment Sample

- 2013, King County
- 2011, King County
- Detected concentration is greater than SCO
- Detected concentration is greater than CSL

- CSO
- Stormwater Outfall
- King County Tax Parcels
- Navigation Channel
- UW Research Vessel Berthing Areas
- Approximate Shoreline
- Bathymetry (NAVD88, feet)

NOTE:
Berthing areas and outfall locations are approximate.



ANCHOR QEA

Feet
0 50 100

Figure 3-1
Site Features
University RS Overflow
King County Sediment Management Plan

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three Sediment Management Areas, six cleanup alternatives are developed and compared, as follows:

- Alternative 1 – MNR (Monitored Natural Recovery)
- Alternative 2 – ENR (Enhanced Monitored Natural Recovery)/MNR
- Alternative 3 – In situ treatment/ENR/MNR
- Alternative 4 – Capping/ENR/MNR
- Alternative 5 – Removal/ENR/MNR
- Alternative 6 – Maximum Removal/ENR

The SMS evaluation criteria specified in WAC 173-204-570 are used to evaluate the alternatives.

3.3 Alternatives Analysis

Alternatives 1 and 6 would likely not be selected under SMS. At one end of the alternative array, Alternative 1 has a restoration timeframe that is longer than 10 years, and unless sources can be better controlled, there is uncertainty whether the requirements of a sediment recovery zone can be met. At the other end of the alternative array, Alternative 6 is disproportionately costly compared to Alternative 5, without achieving proportional increased benefit.

Of the remaining alternatives, Alternative 2 and Alternative 5 are the most compatible with site-specific conditions and have better DCA results. Alternative 3 features in situ treatment, which reduces bioavailability in hydrophobic organic compounds (e.g., PCBs), but may not address other contaminants at the site. Alternative 4 features capping, which fully isolates contaminated sediment, but has the drawback of shallowing up the aquatic area and therefore may not be compatible with berthing activities at the site. In addition, the thin deposit of contaminated sediment at the site (<1 foot) does not warrant the long-term maintenance and monitoring costs associated with capping. Capping could be reconsidered if thicker deposits of contaminated sediments are discovered in nearshore areas.

Both Alternatives 2 and 5 are expected to be effective at meeting cleanup standards. Alternative 2 has fewer impacts during construction but leaves more contaminated sediment on site. Alternative 2 is applicable if natural recovery is observed to be occurring at the site.

Alternative 5 has more impacts during construction and leaves less contaminated sediment on site. Alternative 5 relies less on natural recovery and therefore is more applicable if natural recovery is not being observed at the site. The preliminary estimated costs are $840,000 for Alternative 2 and $1,300,000 for Alternative 5, including design, permitting, construction, post-construction and long-term monitoring, and contingency.

3.4 Additional Evaluations

Additional evaluations would be useful to develop the CAP and provide important information to select the preferred alternative. These evaluations could address the following areas:

- **Source Control:** Measure solids concentrations and estimate loading from University RS Overflow and UW stormwater outfalls.
- **Natural Recovery:** Measure trends in surface sediment concentrations by reoccupying sampling stations or by additional core sampling.
- **Depth of Contaminated Sediment:** Perform more coring to further characterize the volume of contaminated sediment at the site.
- **Sediment Stability:** Evaluate potential propeller wash, wind/wave, and currents at the site to identify stable grain sizes and slope angles for remediation.
- **Site Uses:** Verify the UW navigation depth needs and the condition of the over-water structure located in the sediment cleanup unit.

3.5 Timeline

GSI is currently being designed to reduce flows to the University RS Overflow. The design for the storage tank to complete control will commence in 2022, and be constructed by approximately 2029. Prior to construction of the storage tank, sources will be characterized and traced, and recontamination potential will be reassessed. This information will be used to inform the development of a CAP and a preferred cleanup alternative. Based on modeling, cleanup activities should not commence until after the storage tank is constructed, to minimize recontamination potential. This assumption can be revisited following GSI completion.

4 CONCLUSIONS AND NEXT STEPS

This SMP update analyzed multiple lines of evidence for each King County CSO discharge location, and developed a sediment management strategy for each. The lines of evidence include the following:

- Existing sediment cleanup actions
- CSO control status
- Model predicted solids deposition
- Concentrations measured in surface sediment
- Nearby pathways and potential sources

These lines of evidence were used to group CSO discharge locations that require similar sediment management strategies. The anticipated next steps for these CSOs, grouped by strategy, are outlined below.

4.1 CSOs Part of an Existing Cleanup

As discussed in Section 2.5.1, fourteen CSOs and two CSO treatment plant outfalls are being addressed as part of an existing cleanup or through the original SMP. Eleven of these are part of the CERCLA cleanup process for the LDW (Hanford #1 Overflow, Duwamish PS, W Duwamish Overflow, Brandon St. RS Overflow, Terminal 115 Overflow, S Michigan St RS Overflow, W Michigan St. RS Overflow, E Marginal Way PS Overflow, 8th Ave. S Overflow, Norfolk St. Overflow, and Henderson/ MLK Outfall) and East Waterway Superfund site (Lander Street RS Overflow, and Hanford #2 RS Overflow). For the LDW, EPA has produced an ROD that will determine the cleanup actions at each discharge location. Cleanup will occur following ongoing remedial design sampling and analysis. For the East Waterway Superfund Site, the East Waterway Group (which includes King County) is in the process of finalizing a Feasibility Study with EPA. Cleanup will commence after EPA develops the ROD and remedial design is completed.

King County has performed or anticipates it will be required to perform cleanup under the MTCA/SMS process for sediments proximal to two other CSOs and one treatment plant outfall (Denny Way RS Overflow and the co-located Elliott W Outfall; and King St. RS Overflow). For Denny Way RS Overflow/Elliott W Outfall, an interim remedial action was conducted

under an Agreed Order (No. DE 5068) with Ecology and was completed in 2008. Monitoring at the site tracked natural recovery trends of sediments with SMS exceedances. Sediments around the perimeter of a cap placed in 1990 offshore of the 2008 cleanup area are being evaluated for additional cleanup actions by King County. Once a CAP is approved by Ecology for the site, additional cleanup actions will then be performed (potentially scheduled as early as 2018).

For King St. RS Overflow, the remedial strategy identified in the original SMP is to cap contaminated sediments in coordination with projects proposed by WSDOT and the City of Seattle. Coordination will be pursued and further action may be initiated as early as 2019 or following completion of the King St. RS CSO control project, depending on recontamination potential as defined during the evaluation.

4.2 CSOs Identified for No Further Action

Thirteen CSOs were identified as needing no further action (North Beach PS WW Overflow, S Magnolia Overflow, 53rd Ave. SW PS Overflow, 63rd Ave. SW Overflow, SW Alaska St. Overflow, Murray St. PS Overflow, Harbor RS Overflow, Montlake RS Overflow, Matthews Park PS Overflow, Belvoir PS Overflow, 30th Ave. NE Overflow, E Pine St. PS Overflow, and Rainier Ave. PS Overflow).

Two CSO treatment plants required site characterization under past NPDES permits and repeatedly demonstrated compliance with SMS. This document demonstrates compliance with the SMS for:

- Carkeek Outfall
- Alki Outfall

All CSOs are monitored as required by the King County CSO NPDES permit. This monitoring includes a requirement to evaluate sediment at completion of control, to demonstrate compliance with the SMS (*Post-construction Monitoring Plan*; King County 2012). These CSOs will not require additional post-construction sampling because:

1. For CSOs that have already been controlled, and sediments comply with the SMS. This document demonstrates compliance with the SMS for the following:

- North Beach PS WW Overflow
- 53rd Ave. SW PS Overflow
- 63rd Ave. SW Overflow
- SW Alaska St. Overflow
- 30th Ave. NE Overflow

2. For CSOs not yet controlled, and sediments comply with the SMS and will not require monitoring post construction because discharges will be further reduced. This document demonstrates compliance for the following:

   - S Magnolia Overflow
   - Murray St. PS Overflow
   - Harbor RS Overflow
   - Montlake RS Overflow
   - Matthews Park PS Overflow
   - Belvoir PS Overflow
   - E Pine St. PS Overflow
   - Rainier Ave. PS Overflow

However, if for any reason controlled CSOs do not meet control criteria, then sediments will require reevaluation once control has been re-established.

There are two cases where post-construction monitoring following control could be required. Murray St. PS Overflow is not a cluster of potential concern, but had PAHs elevated above the CSL in one location, while modeling did not predict any CSL exceedances. Belvoir PS Overflow (co-located with 30th Ave. NE Overflow) has recently been defined as uncontrolled based on modeling and could possibly be required to demonstrate compliance once brought back under control. Sampling did not indicate a cluster of potential concern, but has only been characterized by one sample, while modeling did not predict CSL exceedances.

4.3 CSOs Identified for Additional Monitoring

Six CSOs are identified as needing additional monitoring. The following bullets outline the data needs of each location.

- **North Beach PS Inlet Overflow** has already been controlled in 2015, but this intertidal second overflow location at North Beach PS was not sampled and modeling was determined to not be appropriate for these site conditions. Post-construction monitoring will occur, with results submitted to Ecology.
- **Barton St. PS Overflow** had exceedances observed in 2011 but not in the post-construction monitoring in 2016. Additional sampling should reoccupy these locations in 5 to 10 years after the last sampling event, to identify if natural recovery gains have been maintained.
- **Kingdome RS Overflow** had previous exceedances in the 1990s, but the area has been dredged for slip maintenance. Modeling predicts potential for exceedances, although recent sampling does not indicate any. Post-construction monitoring will occur once this CSO is controlled.
- **Chelan Ave.** RS Overflow has been identified as a cluster of potential concern for BEHP, based on 2011 and 2013 sediment sampling, which may be attributable to other sources. Modeling does not predict exceedances attributable to CSO releases alone. Chelan Ave. is within but near the boundary of the West Waterway Operable Unit, which EPA issued a No Action decision for in 2003. The fourth 5-year review in September 2015 concluded that no additional evaluations are required at this time. However, post-construction monitoring will occur once the CSO is controlled.
- **MLK Jr. Way Overflow and Henderson St. PS Overflow (two co-located overflows)** has not been sampled since 2000, but was a cluster of potential concern for PAHs at that time. There are no CSO events on record and nearby pathways and potential sources exist. Further investigation may be warranted. At a minimum, surface sediments will need to be resampled to determine if a cluster of potential concern remains.

4.4 CSOs Identified for Evaluation in the Context of Area-wide Investigation

Five CSOs are located in highly developed areas with impacted sediments from multiple potential sources (Ballard Siphon Overflow, 11th Ave. NW Overflow, 3rd Ave. W Overflow,

Canal St. Overflow, and Dexter Ave. RS Overflow). These CSOs are located in Lake Washington Ship Canal/Lake Union.

Ballard Siphon Regulator and 3rd Ave. W Overflow have recent sediment quality data, and will not require any further local characterization. The other three CSOs will require additional sediment evaluations, which does not need to be done until an area-wide investigation is conducted. Modeling, which is also used for recontamination potential, suggests that CSO discharges from Dexter, 3rd Ave. W, and 11th Ave. NW Overflow could potentially result in a cluster of potential concern for silver. CSO discharges from Canal St. and Ballard Siphon CSOs are unlikely to result in a cluster of potential concern. Further modeling to assess recontamination potential will occur as part of any area-wide investigation.

4.5 CSOs Identified for Cleanup Evaluation

University RS Overflow was identified as a cluster of potential concern from recent sampling and the lines of evidence suggest that a hazard assessment is needed, and identification of a cleanup site is likely. Because a site could be clearly defined, a preliminary evaluation of cleanup alternatives was performed for the University RS Overflow in the SMP update (see Section 3 and Appendix E) to understand the potential cost implications of any cleanup required at this site in order to incorporate into long-range planning.

The CSO is undergoing CSO control work. GSI is currently being designed to reduce flows to the University RS Overflow. The design for a storage tank to complete control will commence in 2022, and be constructed by approximately 2029. Prior to construction of the storage tank, sources will be characterized and traced and recontamination potential will be reassessed. It is anticipated that this information will be used to inform the development of a CAP and a preferred cleanup alternative. Based on modeling, cleanup activities should not commence until after the storage tank is constructed, to minimize recontamination potential. This assumption can be revisited following GSI completion and further source characterization.

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