

Combined Sewer Overflow Control

During heavy rainstorms when combined sewers in Seattle are full, untreated wastewater and stormwater may discharge into Puget Sound, the Duwamish Waterway, Elliott Bay, Lake Union, the Lake Washington Ship Canal, or Lake Washington.¹ These discharges, called combined sewer overflows (CSOs), help protect treatment plants and prevent sewer backups into buildings and onto streets. Although the wastewater in CSOs is greatly diluted, CSOs can carry chemicals and disease-causing pathogens that may be harmful to public health and aquatic life.

The RWSP calls for continued improvements to CSOs. RWSP CSO control policies provide direction regarding control project schedules, stipulating that highest priority be given to controlling CSOs that have the greatest potential to impact human health, bathing beaches, and/or species listed under the federal Endangered Species Act. So far, about one-third of the county's CSO locations are controlled to meet the Washington State Department of Ecology (Ecology) standard of no more than an average of one untreated discharge per year at each CSO location. The RWSP identifies 21 projects to control all King County's CSOs by 2030. The policies also direct the county to implement its long range sediment management strategy and, where applicable, to participate with partners in sharing responsibilities and costs of cleaning up sites such as the Superfund sites in the Lower Duwamish Waterway.

This chapter provides information on CSO control and sediment management activities in 2007. The discussions include plans for activities in 2008.

5.1 CSO Control Activities in 2007

Key achievements of the CSO control program in 2007 are as follows:

- Continued startup of the Mercer/Elliott West and Henderson/Norfolk control systems
- Start of public outreach and document production efforts for the 2008 CSO control plan update
- Start of planning and predesign of the Puget Sound Beach projects
- Incorporation of Ballard CSO control needs in the Ballard Siphon replacement project
- Start of the CSO treatment technology pilot program
- Submission to Ecology of the *Final Public Notification Feasibility Study* and launching of the real-time overflow status Web site
- Continued coordination with the City of Seattle on CSO and stormwater management
- Preparation for a program audit by the U.S. Environmental Protection Agency

¹ Combined sewers exist in older cities across the nation, including Seattle.

5.1.1 Startup of Mercer/Elliott West CSO Control System

The Denny Way/Lake Union CSO control project was under way prior to adoption of the RWSP. This project was a joint effort of King County and the City of Seattle to control CSOs into Lake Union and Elliott Bay. The new Mercer/Elliott West CSO control system was brought online in May 2005. It will control several of the city's CSOs in addition to the county's Denny Way and Dexter Avenue CSOs.

The system operated during the 2005–2006 and 2006–2007 CSO reporting periods (June through May).² Although volumes and frequencies at the Denny Way and Dexter Avenue CSOs have been substantially reduced, these locations are not yet controlled to the state standard.

Seattle and the county have made adjustments to improve system operation and are continuing to assess the need for other refinements to address permit compliance issues (see Chapter 9). For example, the duckbill valve was removed from the outfall of the Elliott West CSO Treatment Facility in March 2007 to address hydraulic problems identified after the large storms in November and December 2006. Because these facilities operate only seasonally and intermittently, several rounds of monitoring, planning and design, implementation, and testing over several seasons may be required to ensure the efficacy of solutions.



5.1.2 Startup of Henderson/Norfolk CSO Control System

The Henderson/Norfolk CSO control project was under way prior to adoption of the RWSP. The new system was brought online in May 2005. This system was built to control two CSOs in Lake Washington and one CSO on the Duwamish Waterway at Norfolk.

The system started full operation in late 2006. Programming errors, which have since been identified and corrected, prevented the Henderson treatment tunnel from operating during the 2005–2006 reporting period. All permit conditions, except for the maximum daily chlorine limit, were met in 2006–2007. Modifications were implemented to correct this deficiency.

After commissioning of this system, all of the county's CSOs along Lake Washington will be controlled.

5.1.3 2008 CSO Control Plan Update

To implement RWSP CSO control policies and prepare for the 2008 CSO control plan update, the county's Wastewater Treatment Division (WTD) reviewed the benefits of continuing the

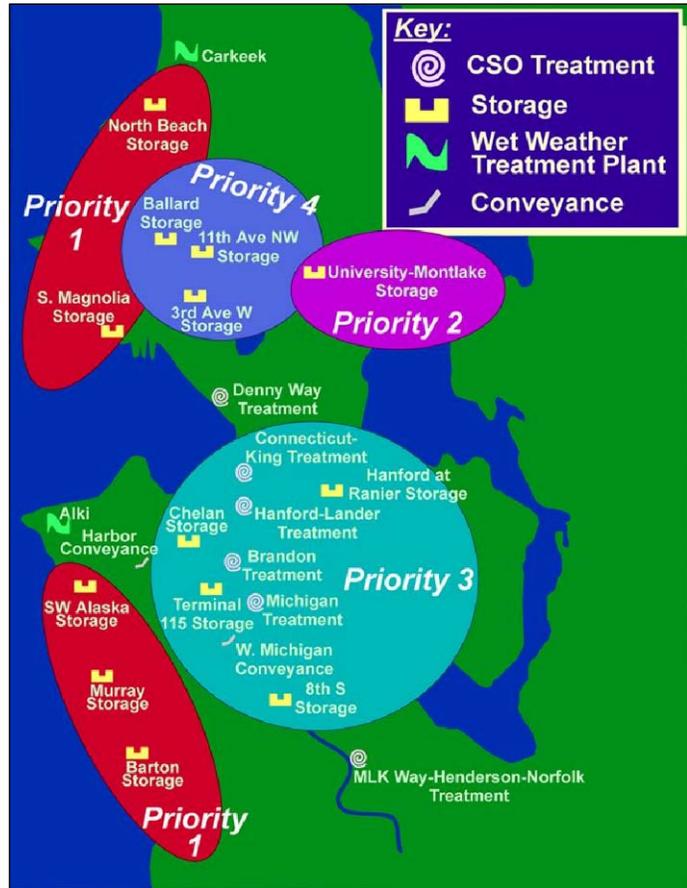
² CSO volumes and frequencies are reported to Ecology for the period from June 1 through May 31 each year so as to capture data for a whole wet season.

CSO control program outlined in the RWSP.³ The CSO control program review was completed and transmitted to the Metropolitan King County Council in spring 2006.

The review confirmed that the schedule for completing the CSO control projects meets the RWSP’s direction to prioritize projects according to their potential to protect human health, the environment, and endangered species.

The project priorities are shown in Figure 5-1 and described below.

- Priority 1, CSOs near Puget Sound Beaches.** Four projects are under way and are scheduled for completion in 2013 (described later in this chapter).⁴
- Priority 2, University-Montlake CSO.** This CSO is located at the east end of the Lake Washington Ship Canal. The control project, scheduled for completion in 2015, was given a high priority because of the amount of boating in that area and the associated potential for secondary contact with the water.
- Priority 3, CSOs Along the Duwamish River and in Elliott Bay.** The RWSP calls for completion of nine projects along the Duwamish Waterway and in Elliott Bay between 2017 and 2027. These projects were given third priority because King County’s 1999 *Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay* indicated that the level of bacterial pollution originating upstream of CSOs was high enough to dwarf any improvements in water quality resulting from CSO control projects.



Note: The SW Alaska Storage project is no longer needed; updated monitoring and modeling data indicate that this CSO is already controlled.

Figure 5-1. Prioritized RWSP CSO Projects

³ CSO control plan updates are prepared in conjunction with National Pollutant Discharge Elimination System (NPDES) permit renewal applications for the West Point Treatment Plant. The permit is renewed about every five years. The previous update was submitted in 2000.

⁴ The SW Alaska CSO control project, also included as a Puget Sound Beach project in the RWSP, was removed from the list. The CSO at this site is controlled as a result of a project to transfer flows from the Alki drainage basin to West Point and to treat excess flows at the Alki CSO Treatment Plant.

- **Priority 4, CSOs at the West End of the Ship Canal.** Three projects to control CSOs at the west end of the Lake Washington Ship Canal are scheduled to be completed by 2030. These are the last projects to be completed because significant CSO control had already been accomplished in this area prior to adoption of the RWSP. As described later in this chapter, it is possible that the Ballard CSO will be controlled through the Ballard Siphon replacement project.

The priorities and schedule are being carried forward in the 2008 CSO control plan update. Work on the update began in 2006 with a public workshop and continued in 2007 with public outreach and document production activities. The update will be submitted to Ecology in mid 2008.

WTD is in the process of analyzing the differences between predicted and actual CSO frequency and volume in order to update and recalibrate its hydraulic model. Recalibration is done routinely to ensure that the model accurately predicts actual conditions. The process should be complete in late 2008 and may lead to changes in sizing, schedules, and costs of CSO control projects. At the end of 2010, WTD will complete another CSO control program review that incorporates information from the recalibrated hydraulic model, a review of technologies including the results of CSO treatment pilots under way, and any new environmental or public health findings with implications for CSO control. Project definitions and implementation order may be redefined at that time; any modifications will be sent to the King County Council for approval.

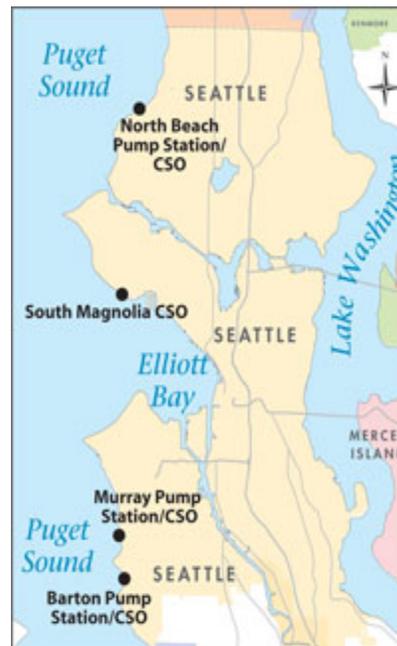
The 2000 CSO control plan update and the 2006 CSO control program review are available at <http://dnr.metrokc.gov/wtd/cso/library.htm#plans>.

5.1.4 Puget Sound Beach Projects

In January 2007, King County hired a consultant to conduct the planning and predesign phase of the four CSO control projects along Puget Sound beaches—Murray and Barton in West Seattle, South Magnolia along north Elliott Bay, and North Beach near Carkeek Park. Because the Barton Pump Station sends flow to the Murray Pump Station and anything that happens at one affects the other, design and construction of the pump station upgrades and CSO control projects are being coordinated.

Control options that may be considered, either alone or in combination, are as follows:

- Store peak flows during large storms and send flows to the existing treatment plant once the storm passes
- Increase pumping and conveyance capacity to direct peak flows to existing treatment facilities
- Reduce peak flows of stormwater and groundwater into the wastewater collection system, including the potential use of low-impact development



- Treat peak flows at a new local treatment facility during large storms

Alternative control options and sites will be identified based on screening criteria. Initial criteria have been developed and will be further refined based on community feedback. Community meetings have been held in each of the four project basins. Public comments are being tracked and will be used to involve stakeholders in future community meetings.

Flow monitoring in the City of Seattle's sewer system will be conducted in each of the four basins to assess whether removing stormwater from these sewers is a viable option for CSO control. In addition, the use of green infrastructure will be explored as an alternative for CSO control in one of the basins. The most suitable basin will be identified in cooperation with the City of Seattle, and the feasibility and costs of the strategy will be assessed.

Pre-design will continue through 2009 and end with issuance of facility plans. Washington State low-interest loans were awarded to fund facility plans for all but the South Magnolia project. Construction is expected to begin in 2011 and to be completed by 2013. More information can be found at <http://dnr.metrokc.gov/wtd/projects/cso/index.htm>.

5.1.5 Ballard Siphon Replacement Project and CSO Control

WTD continues to find opportunities to optimize cost-effectiveness by coordinating CSO control with other WTD projects. The Ballard Siphon replacement project is one example of such coordination. The project—initiated in 2006 and scheduled for completion in 2011—will protect water quality in the Lake Washington Ship Canal by replacing the 70-year-old wooden sewer pipe that extends across the floor of Salmon Bay near the Hiram M. Chittenden Locks.

The project is being designed to bring the CSO at the Ballard Regulator Station under control and eliminate the need for the CSO storage project at this location that was scheduled in the RWSP for completion in 2029. Replacement of the siphon also will reduce CSOs at the 11th Avenue Regulator Station, likely reducing the size of the CSO storage project planned to be completed at this location in 2030.

5.1.6 CSO Treatment Technology Pilot Program

The RWSP calls for satellite CSO treatment for CSOs at four sites—Kingdome-Connecticut, Hanford-Lander, Brandon, and Michigan. Flows at these CSO sites are so high that storage facilities to hold all the flows would be large, difficult to site, and prohibitively expensive. Even if such storage facilities could be built, they could not be drained to regional plants before the next storm begins to fill them again.

The RWSP called for the use of conventional primary sedimentation for CSO treatment. Since adoption of the RWSP, some technological advancements have occurred that could have application to CSO control. In 2007, a program was started to pilot test emerging treatment technologies for these sites. The objective of the program is to determine whether high-rate sedimentation technologies hold the potential to be cost-effective alternatives to the currently planned conventional primary CSO treatment. The program will provide reliable information to

support decision-making and will help the county to better understand the capabilities and limitations of various technologies. The pilot program consists of three phases:

- Phase 1 (2007) – Project development, jar testing, technology identification, and public involvement
- Phase 2 (2008) – Pilot-scale testing at a treatment plant
- Phase 3 (2009) – Pilot-scale testing at a CSO site, if necessary

5.1.7 Final Public Notification Feasibility Study to Ecology

King County, the City of Seattle, and Public Health–Seattle & King County operate a joint public outreach program to inform the public about the location of CSOs, their occurrence, and the possible health or environmental impacts of CSOs. Signs are posted near CSO outfalls. In addition, the outreach effort includes media releases and a brochure, fact sheet, Web site (<http://www.metrokc.gov/health/hazard/cso.htm>), and telephone number to respond to health concerns regarding CSOs.

The modified National Pollutant Discharge Elimination System (NPDES) permit for West Point required that King County conduct a study to determine the feasibility of providing more immediate notification of overflows, including the feasibility of providing a Web-based notification system.⁵ WTD submitted a draft study report to Ecology in July 2006 and then incorporated Ecology comments on the draft, solicited public input through briefings and displays, and submitted a final report in July 2007. The *Final Public Notification Feasibility Study* can be found at <http://dnr.metrokc.gov/wtd/cso/library/Notification/FinalPublicNotificationFeasibilityStudyReport-July2007.pdf>.

WTD began pilot testing a Web-based real-time notification system in November 2007 (<http://dnr.metrokc.gov/wtd/cso/status/>). A map on the site shows county CSOs that are overflowing or that have overflowed in the last 48 hours. Status of CSO locations that are linked to the county's SCADA system is updated every 10 minutes.⁶ Use of the Web site is being monitored. The county is working with Public Health–Seattle & King County on ways to make the real-time status available by phone and in other languages. If this information is found to be useful, further improvements will be made.

To ensure development of a seamless public information system for all CSOs in the area, the county is coordinating with Seattle Public Utilities in exploring ways to provide real-time status of city-owned CSOs.

⁵ The permit was modified in June 2005 to include the new Mercer/Elliott West and Henderson/Norfolk CSO control systems. CSO public notification programs are required by the U.S. Environmental Protection Agency.

⁶ SCADA = supervisory control and data acquisition.

5.1.8 Coordination with the City of Seattle

Extensive coordination with the City of Seattle, including exchange of rainfall, modeling, flow, and GIS data, has occurred during the year. The county has provided data in support of the city's work in developing a system hydraulic model and in implementing CSO control projects in the Windermere, Genesee, and Diagonal areas. The city has provided data to the county in support of system characterization and consideration of green infrastructure alternatives for the county's Puget Sound Beach projects.

5.1.9 Program Audit

In December 2007, the U.S. Environmental Protection Agency (EPA) began an audit of King County's CSO control program for alignment with EPA's 1994 CSO Control Policy. The City of Seattle's CSO control program began a similar audit at the same time. These audits are being routinely conducted across the country with larger CSO communities. The audits often result in consent decrees covering CSO Long Term Control Plans and project schedules. The county is waiting to receive the audit findings.

5.2 Sediment Management Activities in 2007

King County is responsible for remediating CSO-related sediment contamination under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the state Model Toxics Control Act (MTCA).⁷ To meet RWSP policies, WTD is carrying out a sediment management plan developed in the late 1990s to remediate sediment near CSO outfalls that are contaminated with a variety of heavy metals (lead, copper, zinc), phthalates, polychlorinated biphenyls (PCBs), and hydrocarbons.⁸ Most of the contamination is from the first half of the twentieth century.

Since completion of the sediment management plan, King County has been coordinating its sediment management efforts in the Duwamish Waterway with two federal Superfund projects: the Harbor Island and the Lower Duwamish Waterway projects. The Harbor Island Superfund project will remediate sediments at the county's Lander and Hanford CSOs. The Lower Duwamish Waterway project area includes nine county CSOs.

5.2.1 Sediment Management Plan

Work on three projects in the sediment management plan is under way—cleanup of the Denny Way and Hanford/Lander CSOs and development of a model to better predict the fate and transport of contamination:

- In mid 2007, design was completed for cleanup of the old Denny Way CSO site off of Myrtle Edwards Park. Ecology finalized an Agreed Order and interim action work plan in

⁷ CERCLA is commonly known as Superfund.

⁸ The sediment management plan is available at <http://dnr.metrokc.gov/WTD/sediment/library.htm>

October 2007. King County dredged and capped the area in November 2007–February 2008. Roughly 14,000 cubic yards of sediment contaminated with polychlorinated biphenyls (PCBs), hydrocarbons, and mercury was removed. After dredging, the excavated area was backfilled with clean sand, armor rock, and habitat-enhancing gravel to match the seabed's existing grade. King County will monitor sediment quality at the site over the next 10 years. After five years of monitoring, the county will evaluate alternatives for cleaning up additional areas.

- In 2006, King County, the Port of Seattle, and the City of Seattle formed a group to complete the work necessary to determine the final cleanup of the Duwamish East Waterway (Harbor Island Superfund project). EPA approved the scope of the remedial investigation/feasibility study in spring 2007, and work has started. The county's Hanford/Lander CSOs are part of Superfund cleanup. Approximately 20,000 cubic yards of sediment in front of the Lander CSO will be remediated in winter 2008–2009.
- The model to better predict deposition of contaminants around CSO outfalls will be ready in 2008. The model will help to identify which CSOs are likely to have contaminated sediments and will inform cleanup decisions.

Visit the Sediment Management Program Web site for more information:

<http://dnr.metrokc.gov/wtd/sediment/>.

5.2.2 Lower Duwamish Waterway Superfund Site

The county continues to work to improve water quality in the Lower Duwamish Waterway through actions such as reducing CSOs, restoring habitats, capping and cleaning up sediments, and controlling toxicants from industries and stormwater runoff. WTD is partnering with the City of Seattle, the Port of Seattle, and the Boeing Company under a consent agreement with EPA and Ecology to prepare a remedial investigation/feasibility study for the Lower Duwamish Waterway Superfund site. The draft remedial investigation, which defines the extent and inherent risks of contamination, was released for public review in November 2007 and is expected to be completed in 2008. The feasibility study, which will identify cleanup alternatives, will be completed in 2009.

The county is participating in two early action sites—the Diagonal/Duwamish CSO/Storm Drain and Slip 4 CSO—to clean up portions of the waterway earlier than required.⁹ The cleanup at Diagonal/Duwamish was completed in 2004. The dredged area was capped with 3 to 6 feet of clean sediment and gravel to provide new fish habitat. Follow-up work was completed at the site in February 2005, and post-remediation monitoring at the site is providing critical information that can be used for determining cleanup alternatives for the Superfund site.¹⁰

⁹ The Slip 4 cleanup is being managed by the City of Seattle. King County is partnering with the city on this cleanup effort.

¹⁰ The Diagonal/Duwamish remediation closure report issued in July 2005 summarizes the purpose for and details of the follow-up work. The closure report is available on the Web at <http://dnr.metrokc.gov/wtd/duwamish/diagonal.htm>.

In early 2007, source control sampling from areas upland to Slip 4 indicated that PCBs were still entering the storm drains that discharge to the slip. EPA put the cleanup of Slip 4 on hold until contamination can be adequately controlled to prevent recontamination of the cleanup.

The Lower Duwamish Source Control Work Group continues to meet to discuss source control issues and activities that can affect sediment remediation in the area. In 2007, WTD's Industrial Waste Program participated in source control efforts, including sampling and analysis of industrial waste discharges and of rainfall samples for contaminants, such as phthalates, found in the cleanup area (see Chapter 9).

Visit the Duwamish Waterway Programs Web site for more information:

<http://dnr.metrokc.gov/WTD/duwamish/>.