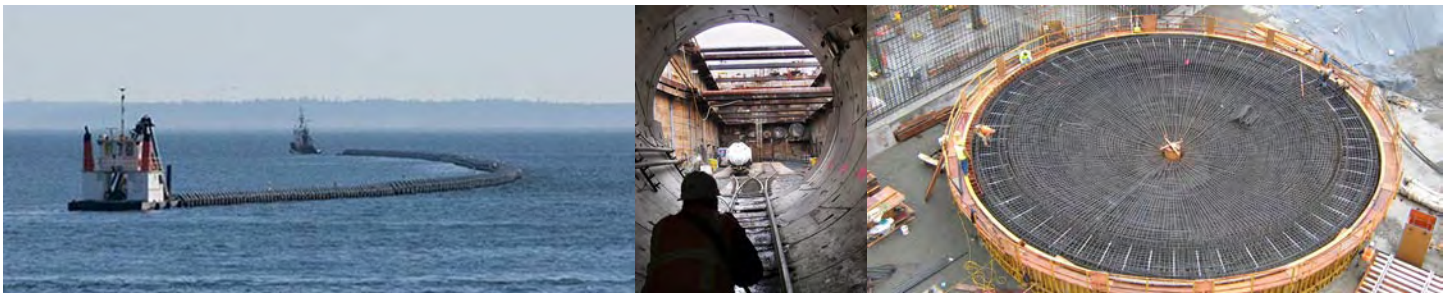

Brightwater Project - outfall pipe under tow; conveyance tunnel and treatment plant under construction

Carnation Treatment Plant

Regional Wastewater Services Plan

2008 Annual Report

September 2009

Hidden Lake Sewer Improvement Project - odor control stack disguised as a tree snag in Boeing Creek Park

Juanita Bay Pump Station

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Regional Wastewater Services Plan (RWSP)

RWSP 2008 Annual Report

September 2009

King County

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Acronyms and Abbreviations

AWWF	average wet-weather flow
BBzP	butylbenzyl phthalate
BEHP	bis-2-ethylhexyl phthalate
BT	Brightwater Tunnel
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	capital improvement plan
CSI	conveyance system improvement
CSO	combined sewer overflow
CY	cubic yard
DNS	determination of non-significance
E&P Subcommittee	Engineering and Planning Subcommittee
Ecology	Washington State Department of Ecology
EECC	Environmental Education/Community Center
EMS	environmental management system
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ETDF	Energy Technology Demonstration Facility
EW	East Waterway
FOG	fats, oil, and grease
GIS	Geographic Information System
GSI	green stormwater infrastructure
H_2S	hydrogen sulfide
HCP	Habitat Conservation Plan
I/I	infiltration and inflow
ISO	International Organization for Standardization
KCIW	King County Industrial Waste Program
LDW	Lower Duwamish Waterway
LHWMP	Local Hazardous Waste Management Program
LWYSA	Lake Washington Youth Soccer Association
MBR	membrane bioreactor
MG	million gallons
mgd	million gallons per day
MOA	memorandum of agreement
MPD	master planned development
MTCA	Model Toxics Control Act
MWPAAC	Metropolitan Water Pollution Abatement Advisory Committee
NACWA	National Association of Clean Water Agencies
NBMA	Northwest Biosolids Management Association
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
PAHs	polycyclic aromatic hydrocarbons
PBDEs	polybrominated diphenyl ethers

PCBs	polychlorinated biphenyls
PSCAA	Puget Sound Clean Air Agency
RCW	Revised Code of Washington
RFI	request for information
RWSP	Regional Wastewater Services Plan
SCWG	Lower Duwamish Waterway Source Control Work Group
Services	National Marine Fisheries and US Fish and Wildlife Services
SPU	Seattle Public Utilities
SR	State Route
SSO	sanitary sewer overflow
SVOC	semivolatile organic compound
TBM	tunnel boring machine
TOC	total organic compound
UW	University of Washington
UWI	Urban Waters Initiative
WAC	Washington Administrative Code
WSU	Washington State University
WTD	Wastewater Treatment Division

Executive Summary

King County Ordinance 15384 and King County Code 28.86.165 require that the King County Executive submit a yearly report to the King County Council on implementation of the Regional Wastewater Services Plan (RWSP). The RWSP outlines a number of important projects, programs, and policies for the county's Wastewater Treatment Division (WTD) to implement through 2030.

The following text summarizes the 2008 RWSP annual report.

Providing Needed Capacity in the Regional System

The RWSP calls for the construction of a new regional treatment plant and conveyance system by the year 2010 or as soon thereafter as possible to provide additional capacity for projected population growth in the northern portion of King County's wastewater service area. This system, called the Brightwater Treatment System, is currently under construction. It will consist of a treatment plant in Snohomish County just north of the City of Woodinville and approximately 14 miles of pipelines constructed in underground tunnels in north King County.

RWSP policies further direct WTD to use the 20-year peak flow storm as the design standard for its separated conveyance system to avoid sanitary overflows and ensure there is sufficient capacity in the regional conveyance system to accommodate projected population growth.

Brightwater Treatment System

WTD made substantial progress on the Brightwater project in 2008. A significant amount of construction was completed in 2008. The system is expected to be operating in fall 2011.

Brightwater Treatment Plant Site

Construction of the Brightwater Treatment Plant continued in 2008. Completed activities include (1) site excavation and earthwork for the tank and gallery foundations, (2) the concrete foundation bottom slabs needed for the grit, headworks, primary clarifiers, aeration basins, and galleries, and (3) the foundations for the digesters and Energy and Solids Building. Work was initiated on the walls for the grit, headworks, primary clarifiers, aeration basins, and galleries. Underground utilities, piping for processes, and conduit for electrical and instrumentation control wiring were installed. Installation of rebar and concrete work for the digesters and Energy and Solids Building also began.

Brightwater Conveyance System

Excavation of the East Tunnel, which consists of about 14,050 feet of 16.6-foot internal-diameter tunnel between the North Creek Portal in Bothell to the Brightwater Treatment Plant, was completed in November.

Progress on the Central Tunnel has been slower than anticipated because of underground conditions. Approximately 56 percent (6,502 feet) of the eastbound portion of the Central Tunnel, which extends from the North Kenmore Portal to the North Creek Portal in Bothell, was completed by the end of December. The tunnel boring machine (TBM) for the westbound portion, which extends from the North Kenmore Portal to the Ballinger Way Portal in Shoreline, was launched in March 2008 and approximately 26 percent (5,136 feet) of the tunneling was completed by the end of the year.

The TBM for the West Tunnel, which extends from the Point Wells Portal in unincorporated Snohomish County and heads east to the Ballinger Way Portal in Shoreline, was launched in September. Approximately 14 percent (2,900 feet) of the tunneling was completed by the end of the year.

Construction of the marine outfall began in spring and was completed in December.

Conveyance System Improvements

The Conveyance System Improvement Program Update, completed in 2007, identifies projects to meet projected capacity needs through 2050. During the update process, King County worked closely with the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) and with individual local sewer agencies.[1] The update recommended that checks and balances be performed, including periodic systematic flow monitoring, field verification, and regular program updates, to update flow projections and avoid overbuilding the system. It also recommended evaluation of demand management methods, such as infiltration and inflow (I/I) reduction, to meet identified conveyance needs.[2]

WTD completed construction of the Hidden Lake Pump Station and Sewer Improvement project and the Juanita Bay Pump Station Replacement project during the year. The force main for the Bellevue Pump Station Upgrade project was also completed, and construction of the project's pump station began. Construction also started on the North Creek Interceptor project. Design activities continued on the Kent/Auburn Conveyance Systems Improvements and the Black Diamond Infrastructure Upgrade projects.

I/I—clean stormwater and groundwater that enters local sewer systems—takes up capacity in the King County regional conveyance and treatment systems and, along with population growth and other factors, drives the need to build additional capacity. The RWSP calls for improvements to

[1] MWPAAC advises the King County Council and Executive on matters related to reducing water pollution. It was created by state law (RCW 35.58.210) and consists of representatives from cities and local utilities that operate sewer systems in King County.

[2] In March 2008, the King County Council approved recommendations made in the update as amendments to RWSP conveyance policies via adoption of Ordinance 16033.

reduce levels of I/I into local collection systems. The Executive's Recommended Regional Infiltration and Inflow Control Program, approved in May 2006 by the King County Council through adoption of Motion 12292, directs the county to work with local agencies to implement two to three initial projects to test the effectiveness of I/I reduction. It is hoped that the projects will help determine whether and under what conditions it is possible to cost-effectively remove enough I/I from the collection system to delay, reduce, or eliminate some otherwise needed regional conveyance system improvement projects.

Activities in 2008 included completing alternatives analysis within the four candidate project areas located in the Cities of Bellevue, Issaquah, and Renton, and in the Skyway Water and Sewer District. In consultation with MWPAAC and the host agencies, two projects were selected as the initial I/I reduction projects for final design and construction—a combined Bellevue and Issaquah project and a Skyway project.

Creating Resources from Wastewater

WTD continues to find beneficial uses for byproducts from wastewater treatment—biosolids and digester gas from the solids treatment process and reclaimed water from the liquids treatment process.

Biosolids Recycling

Highlights of Biosolids Program activities and achievements during the year are as follows:

- Approximately 116,000 wet tons of biosolids were produced in 2008, all of which was recycled as fertilizer and soil amendment for forestry and agricultural applications and to make compost.
- WTD is participating in a research project to quantify the carbon sequestration benefits of using biosolids and other organic residuals as a soil amendment for land application; the project was launched in 2008.
- Predesign was completed on the West Point Treatment Plant Digestion System Improvements project. This project will enhance the reliability of the plant's solids digestion system and reduce the risk of digester upsets under current and future solids loading conditions.
- Planning efforts were initiated to upgrade influent screens at West Point to comply with new amendments to the Washington State rule for biosolids management. The new screens will reduce the amount of non-organic debris in the biosolids. Predesign is expected to begin in summer 2009.
- WTD made progress in its transition from its existing environmental management system (EMS) for biosolids toward gaining certification through the International Organization for Standardization (ISO 14001) for an EMS for WTD's solids operations, including biosolids. The ISO 14001 standard is applicable to more of WTD's operations than other EMS certifications and fits into the division's vision of "Creating Resources from

Wastewater." In 2008, WTD developed a manual that outlines how the division will meet the requirements for ISO 14001 certification for all of WTD.

- WTD issued a request for information (RFI) in July to learn about market options available for supplementing, strengthening, or diversifying its existing biosolids program. The goal of the RFI process is to provide the county with information on options for biosolids management in the next decade that are reliable, cost-effective, publicly acceptable, and provide multiple environmental benefits. Twelve responses to the RFI were received in September; evaluation of the responses will be completed in early 2009.

Reclaimed Water

WTD continues to produce and use reclaimed water at the West Point and South plants. In addition, reclaimed water from South plant is used off-site in the City of Tukwila. The county and the City of Tukwila renewed a sale and distribution agreement for reclaimed water, under which the city will continue to act as a reclaimed water purveyor in its service area. The city uses reclaimed water from South plant for irrigation of Fort Dent Park (including newly constructed soccer fields where the Seattle Sounders Football Club practices) and city public works uses such as street sweeping and sewer flushing. In addition, the Tukwila City Council approved an agreement in July to extend the reclaimed water distribution line from South plant to Foster Golf Links.

In keeping with RWSP policy, new treatment plants are incorporating production and distribution of reclaimed water into their designs. The Carnation Treatment Plant, which uses membrane bioreactor technology (MBR) and is designed to treat all the wastewater to Class A reclaimed water standards, began operating in May 2008.[3] The plant has a dual discharge system: an outfall that discharges to the Snoqualmie River and another outfall that discharges to a wetland in the Chinook Bend Natural Area. Discharge to the wetland serves as the primary discharge location. In August 2008, the Carnation Treatment Plant earned the WateReuse Association's Small Project of the Year Award in recognition of the facility's innovative use of reclaimed water to enhance wetlands and preserve local habitat.[4]

Work continued in 2008 on the Brightwater Reclaimed Water System. Construction of the South Segment of the system is expected to be substantially complete in 2009. WTD continued to work with local jurisdictions, water purveyors, and other interested entities to identify and confirm potential markets and demand for reclaimed water in the South Segment area, which includes the Sammamish Valley. WTD also continued to work with water purveyors in this area to determine their interest in serving as reclaimed water purveyors in their service areas.

[3] "Class A" is the highest quality reclaimed water and is allowed for all permitted uses of reclaimed water, which include non-potable uses such as irrigation, groundwater recharge, wetland enhancement, streamflow augmentation, and street cleaning

[4] The WateReuse Association is a nonprofit organization whose mission is to advance the beneficial and efficient use of water resources through education, sound science, and technology using reclamation, recycling, reuse, and desalination for the benefit of its members, the public, and the environment. More information on the association is available on the Web at http://www.watereuse.org/.

WTD continued to participate in reclaimed water study efforts. The turf grass irrigation study, initiated in 2007, was completed in 2008. An ornamental plant and food crop irrigation study was initiated in 2008. These studies were undertaken in partnership with University of Washington researchers to develop local, independent, best-available science about the public health and environmental impacts of using reclaimed water.

In July 2008, WTD began a planning process to develop a Reclaimed Water Comprehensive Plan to determine if, how, when, where, and by what funding mechanisms over the next 30 years the county's existing reclaimed water program should expand. WTD is working with a broad range of interested parties and individuals on this multiyear planning effort.

Energy Generation from Digester Gas

Digester gas—energy-rich methane gas produced during solids treatment—is used at the West Point and South plants to produce power and heat for plant processes and buildings. In addition, the remainder of the gas at South plant, about 2.1 million therms, which is enough to serve more than 2,500 homes, was "scrubbed" and sold to Puget Sound Energy.

WTD is carrying out a Waste-to-Energy project at the West Point plant to install a new cogeneration facility so that digester gas can again be used to generate electricity at the plant. The previous power cogeneration engines, installed in 1984, were removed from the plant site in 2008 after reaching the end of their useful life. Final design efforts on this project began in September and are expected to be complete in spring 2009.

Some of the digester gas that will be produced at the Brightwater Treatment Plant will be used to fuel a boiler that generates heat for the digestion process and for buildings. In addition, plans are under way to develop an Energy Technology Demonstration Facility at the plant site for research of potential technologies for producing alternative forms of energy from digester gas. Final design of the facility was under way in 2008 and is expected to be complete in May 2009.

Protecting Water Quality and Complying with Regulations

RWSP reporting policies require a summary in the annual reports of WTD's water quality management programs and its compliance with the Endangered Species Act and other agency regulations and agreements. WTD manages several programs to protect and preserve water quality, including wastewater treatment, combined sewer overflow control, sediment management, and source control.

The policies also require the inclusion of a report on the results of the water quality monitoring program, which measures water and sediment quality near WTD outfalls and facilities and compares the results with measurements in other areas in the same water bodies. The 2008 report, included as an appendix to the RWSP 2008 Annual Report, indicates that the quality of marine and fresh waters in King County is fair to good.

Treatment Plants

Effluent from King County's treatment plants must meet National Pollutant Discharge Elimination System (NPDES) permit requirements and Washington State Water Quality Standards. The quality of treated effluent from its four secondary plants remained high in 2008. NPDES permit limitations were met for all the plants, including the new Carnation Treatment Plant. Both the South and West Point Treatment Plants earned the National Association of Clean Water Agencies Gold Peak Performance Award for achieving 100 percent compliance with their NPDES permits for an entire calendar year. These two plants also received the Platinum Peak Performance Award for multiple years of consecutive gold performance.

CSO Control and Sediment Management

King County's combined sewer overflow (CSO) facilities are regulated through West Point's NPDES permit. WTD also submits a report to the Washington State Department of Ecology (Ecology) each year on annual CSO volumes and frequencies and on progress made to control its CSOs.[5]

Almost 20 years of data demonstrate progress toward the control goal. As of May 2008, about 16 of King County's 38 CSOs are controlled. Two other CSOs—part of the Mercer/Elliott West CSO control system that came online in 2005—are expected to achieve control after startup adjustments and modifications are made to the system.[6] Control status of county CSO locations will be confirmed in the hydraulic model recalibration that is scheduled to be ready in 2010. The remaining 20 uncontrolled CSOs will meet state standards as projects listed in the RWSP are completed between 2013 and 2030.

Four of the RWSP CSO control projects are under way. Predesign on these projects, collectively called the Puget Sound Beach projects, was under way in 2008. Construction is expected to begin in late 2013. Another CSO at the Ballard Regulator Station, scheduled in the RWSP to be controlled in 2029, will be brought under control in 2012 through the Ballard Siphon Replacement project. Other accomplishments of the CSO Control Program in 2008 include making progress on a pilot program to assess CSO treatment technologies for future CSO control projects. Project development, jar testing, and technology identification was completed, and pilot-scale testing at the West Point plant of two technologies began in late 2008. WTD also submitted the 2008 CSO plan update to Ecology as part of West Point's NPDES permit renewal application.

To meet RWSP policies, WTD is carrying out a sediment management plan developed in the late 1990s to remediate contaminated sediment near CSO outfalls. Most of the contamination is from the first half of the twentieth century. Since completion of the sediment management plan, King County has been partnering with other agencies on sediment management in the Duwamish

[5] "Control" is defined as meeting the Washington State standard of an average of no more than one untreated discharge per year per outfall.
[6] The two CSOs are the Denny Way and Dexter Avenue Regulator Stations.

Waterway under two federal Superfund projects: the Harbor Island and the Lower Duwamish Waterway projects.[7]

Work on projects identified in the sediment management plan is under way. King County completed dredging and capping of the area near the former Denny Way CSO in February 2008 and in April, began a 10-year program to monitor sediment quality at the site. After completion of five years of monitoring, the county will evaluate alternatives for cleaning up nearby areas.

The draft remedial investigation for the Lower Duwamish Waterway Superfund site was completed in 2008 and is expected to be finalized in 2009. The feasibility study, which will identify cleanup alternatives, will be completed in 2009.

Source Control

King County operates two source control programs: the King County Industrial Waste Program (KCIW) and the Local Hazardous Waste Management Program (LHWMP). Both programs work to control pollutants at their source, thereby keeping them out of the wastewater system and, in turn, out of surface waters and the environment.

In 2008, 133 permits and 319 industrial waste discharge approvals were in effect, 435 inspections were conducted, and 112 Notices of Violation were issued. KCIW inspected 97 dental offices in 2008 as part of its nationally prominent program to reduce mercury discharges to sewers. KCIW continued to participate in source control efforts in the Lower Duwamish Waterway, including sampling and analysis of industrial waste discharges and rainfall for contaminants such as phthalates, and continued to work on the East Waterway source control project as part of Harbor Island Superfund project.

In 2008, the LHWMP collected 1,826 tons of household hazardous waste from more than 44,877 customers, some of which may otherwise have entered King County sewers. Also in 2008, LHWMP began a pilot project to determine whether it should provide collection for businesses that generate infrequent, small volumes of hazardous waste. By the end of the year, 278 businesses had brought in 31.2 tons of waste.

Endangered Species Act Compliance

WTD continues to consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service ("Services"), as required under Section 7 of the Endangered Species Act (ESA), on projects that require a federal permit or receive federal funding. WTD's past efforts to develop programmatic agreements with the Services (habitat conservation plan, programmatic biological assessments) and its funding of a position at National Marine Fisheries Service to review projects have helped make the Section 7 consultations more predictable and efficient.

[7] Superfund is the common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In 2008, WTD ESA compliance activities included completing a technical memorandum on the impact of reclaimed water on ESA-listed species.

Being a Good Neighbor

In all its projects, WTD strives to minimize adverse effects of its facilities on the surrounding community through facility design features, construction best practices, and responsiveness to community input. RWSP policies direct WTD to employ stringent odor control at existing and new facilities.

Odor Control

The RWSP includes policies to guide King County in achieving its goal of preventing and controlling nuisance odor occurrences at all wastewater treatment plants and associated conveyance facilities. The policies also call for implementation of an odor prevention program that goes beyond traditional odor control.

The policies require retrofitting existing treatment and conveyance facilities. Retrofitting work done so far includes the following:

- At the West Point plant, efforts focused on evaluating odor control improvements that were completed in 2007. The evaluation found that the odor intensity from these areas was reduced by 79 percent (target reduction was 81 percent) and that odor frequency was reduced by 81 percent (target reduction was 90 percent). Operational activities were implemented to improve these results. WTD will evaluate the effects of these activities in 2009 and 2010.
- At South plant, efforts focused on evaluating odor control improvements that were completed in 2007. Preliminary modeling results indicate that the intensity of maximum odor impact was reduced by 91 percent (target reduction was 99 percent) and that the frequency of impacts was reduced by 76 percent (target reduction was 96 percent). Operational activities to help improve these results were implemented in 2008. Additional improvements are planned for South plant to help meet the odor reduction targets.
- Thirteen projects have been identified to improve odor control in the county conveyance system. Two projects were completed in 2008: installation of carbon bed odor scrubbers and chemical injection systems at the Hidden Lake and Juanita Bay Pump Stations.

RWSP policy directs the county to construct odor control systems for new regional treatment plants that meet the “best in the country for new facilities” level, as described in Attachment A to Ordinance 14712. Brightwater’s odor control system was designed to ensure there are no detectable odors at the property line for the treatment plant. Concrete work on the odor facilities began in 2008 and is expected to be complete by the end of 2009.

Public Involvement

In accordance with RWSP public involvement policies, WTD works with local jurisdictions, affected residents and businesses, and permitting and regulatory agencies during the planning, environmental review, design, and construction of its projects to ensure its facilities are good neighbors. Public involvement activities associated with the capital projects discussed in the RWSP 2008 Annual Report include community meetings, informational booths, up-to-date Web sites, 24-hour construction hotlines, newsletters, bulletins, and press releases.

Tracking Costs

The 2008 cost estimate for implementing RWSP projects and programs through 2030 is approximately $3.35 billion, an increase of about $24 million, or 0.69 percent, from the 2007 RWSP cost estimate. The majority of this difference is attributed to unanticipated construction delays, refinements in project scope, inflation, and unpredictability in the construction bid market.

Nearly one-fourth of the 2008 RWSP cost estimate represents planning-level costs. Planning-level cost estimates are based on generic facility concepts. The accuracy of a project's cost estimate will increase as the project progresses through the project life cycle. Costs for projects in planning can have a rough order-of-magnitude estimate in the range of -50 to +100 percent.[8,9] By the time a project enters the construction phase, estimates typically narrow to a range of -10 to +15 percent.

[8] Project Management Institute's *A Guide to the Project Management Body of Knowledge*, third edition, 2004.
[9] Order-of-magnitude estimates are made without detailed engineering data. They are often referred to as "ball park" estimates.

Chapter 1

Introduction

The purpose of the Regional Wastewater Services Plan (RWSP) 2008 Annual Report is to describe the progress made during 2008 in implementing the major programs and projects in the RWSP. The report is presented in response to the RWSP reporting policies outlined in Ordinance 15384 and King County Code 28.86.165.[1]

Chapters in this report describe 2008 accomplishments and, in some cases, anticipated achievements for 2009. The subject of each chapter is as follows:

- Chapter 2 describes the progress made on the Brightwater Treatment System.
- Chapter 3 describes amendments made to RWSP conveyance policies and summarizes the progress made on RWSP conveyance projects that are in design or construction.
- Chapter 4 reports on the progress made on initial projects to reduce infiltration and inflow.
- Chapter 5 summarizes the key achievements of the Combined Sewer Overflow Control Program. It also describes efforts to improve water quality in the Lower Duwamish Waterway and the activities associated with the county's Sediment Management Program.
- Chapter 6 discusses the efforts to prevent and control nuisance odors at the county's treatment plants and conveyance facilities.
- Chapter 7 summarizes achievements associated with biosolids recycling and energy recovery efforts.
- Chapter 8 provides information on reclaimed water activities.
- Chapter 9 provides an update of the RWSP cost estimates through 2030 and provides information on the Productivity Initiative Pilot Program.
- Chapter 10 reports on the Wastewater Treatment Division's water quality management and compliance activities.

The remainder of this chapter provides background on King County's wastewater treatment system and the RWSP.

[1] Previous RWSP annual reports are available at http://www.kingcounty.gov/environment/wtd/Construction/planning/rwsp/Library.aspx.

1.1 King County's Wastewater Treatment System

King County protects water quality and public health in the central Puget Sound region by collecting and treating wastewater from 17 cities, 16 local sewer utilities, and 1 Indian tribe. WTD serves about 1.5 million people within a 420-square-mile service area, which includes most urban areas of King County and parts of south Snohomish County and northeast Pierce County. King County's wastewater system (Figure 1-1) includes two large regional treatment plants, the West Point Treatment Plant in the City of Seattle and the South Treatment Plant in the City of Renton, two small treatment plants (one on Vashon Island and one in the City of Carnation), one community septic system (Beulah Park and Cove on Vashon Island), four combined sewer overflow (CSO) treatment facilities (Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk—all in the City of Seattle), over 350 miles of pipes, 19 regulator stations, 42 pump stations, and 38 CSO outfalls. Construction is under way on the Brightwater Treatment System, which includes a new regional treatment plant, associated conveyance facilities, and a marine outfall. The Brightwater system is expected to be operating in fall 2011.

More information on the county's wastewater projects and programs is available at http://www.kingcounty.gov/environment/wtd.aspx.

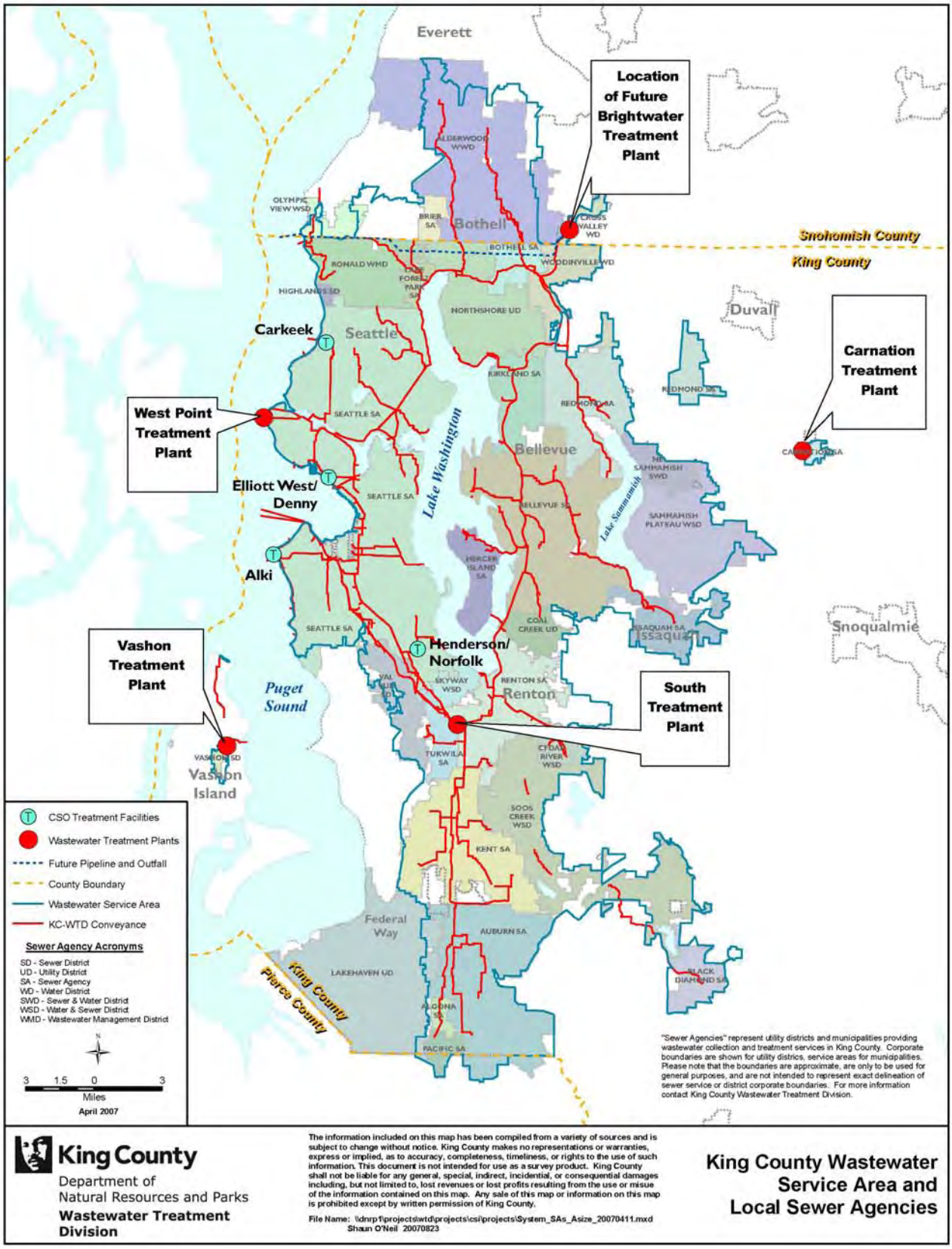


Figure 1-1. King County Wastewater Service Area

1.2 Regional Wastewater Services Plan

In the 1990s, wastewater flow estimates based on projected population growth estimates in King County's wastewater service area indicated that King County's regional wastewater treatment system would run out of capacity by 2010. To ensure the continuation of high-quality and effective wastewater treatment services in the future, the county carried out an intensive planning effort, involving elected officials, representatives from local sewer agencies, organizations, and individuals from around the region. The RWSP resulted from this effort and was adopted by the King County Council in November 1999, through Ordinance 13680.

The RWSP outlines a number of important projects, programs, and policies for King County to implement through 2030. It calls for building a new treatment plant, known as "Brightwater," to accommodate growth in the northern portion of the wastewater service area. The plan also calls for improvements to the regional conveyance system to meet the 20-year peak flow storm design standard and accommodate increased flows; improvements to reduce existing and future levels of infiltration and inflow (clean groundwater and stormwater) into local collection systems; and improvements to control CSOs so that an average of no more than one untreated discharge occurs per year at each CSO site by 2030.[2]

RWSP Annual Reporting Policies

The policies below were established via adoption of Ordinance 15384. They guide the preparation of the RWSP annual reports.

"A. Regional wastewater services plan annual report. The executive shall submit a written report to the council and RWQC in September each year until the facilities in the RWSP are operational. This report, covering the previous year's implementation, will provide the following:

1. *A summary of activities for each major component of the RWSP, including treatment, conveyance, infiltration and inflow, combined sewer overflows, water reuse, biosolids and highlights of research and development projects underway and proposed for the coming year;*
2. *Details on each active RWSP project in the capital budget, including a project summary, project highlights, project issues, upcoming activities, schedules, and expenditures summary including labor staff and miscellaneous services, a description of adjustments to costs and schedule and a status of the projects contract;*
3. *A status of the odor prevention program, including a listing and summary of odor complaints received and progress on implementing odor prevention policies and projects;*
4. *A summary of the previous year's results for the comprehensive water quality monitoring program;*
5. *A review of the plan elements, including water pollution abatement, water quality, water reclamation, Endangered Species Act compliance, biosolids management and variability of quality over time, wastewater public health problems, compliance with other agency regulations and agreements, to ensure it reflects current conditions; and*
6. *An update of anticipated RWSP costs through the year 2030."*

In addition, the RWSP identifies the need to expand South plant in Renton by 2029 to handle projected increased wastewater flows in the southern and eastern portions of the county's wastewater service area.

[2] The Washington State Department of Ecology (Ecology) regulates the level of CSO control based on the number of untreated CSO events that occur in a year. Ecology defines "the greatest reasonable reduction" in CSOs (Chapter 90.48 RCW) as being "control of each CSO in such a way that an average of one untreated discharge may occur per year" (WAC 173-245-020).

Ordinance 13680 was codified in the King County Code as Chapter 28.86. Amendments to Ordinance 13680 and to Chapter 28.86 of the King County Code have been made since the RWSP's adoption. Amendments have included updates to the financial policies, new odor control policies for the county's existing regional treatment plants and facilities, a new section on reporting policies, and updates to the conveyance policies.

More information on the RWSP is available at http://www.kingcounty.gov/environment/wtd/Construction/planning/rwsp.aspx.

Chapter 2

Brightwater Treatment System

The RWSP calls for the construction of the Brightwater Treatment System by 2010 or as soon thereafter as possible to handle wastewater flows from the northern portion of King County's wastewater service area.

The locations of the Brightwater facilities are shown in Figure 2-1. The treatment plant is located in unincorporated Snohomish County, just north of the City of Woodinville. It will have capacity to treat an average of 36 million gallons per day (mgd) with room for future expansion to 54 mgd. In addition to the treatment plant, the Brightwater system includes approximately 14 miles of pipelines to be constructed in underground tunnels in north King County. The pipelines will convey untreated wastewater (influent) to the plant, treated wastewater (effluent) from the plant for discharge through an outfall in Puget Sound, and reclaimed water for distribution to customers located along the effluent pipeline and down through Sammamish Valley (see Chapter 8).

Construction of the Brightwater system started in 2006; the system is expected to be operating in fall 2011.

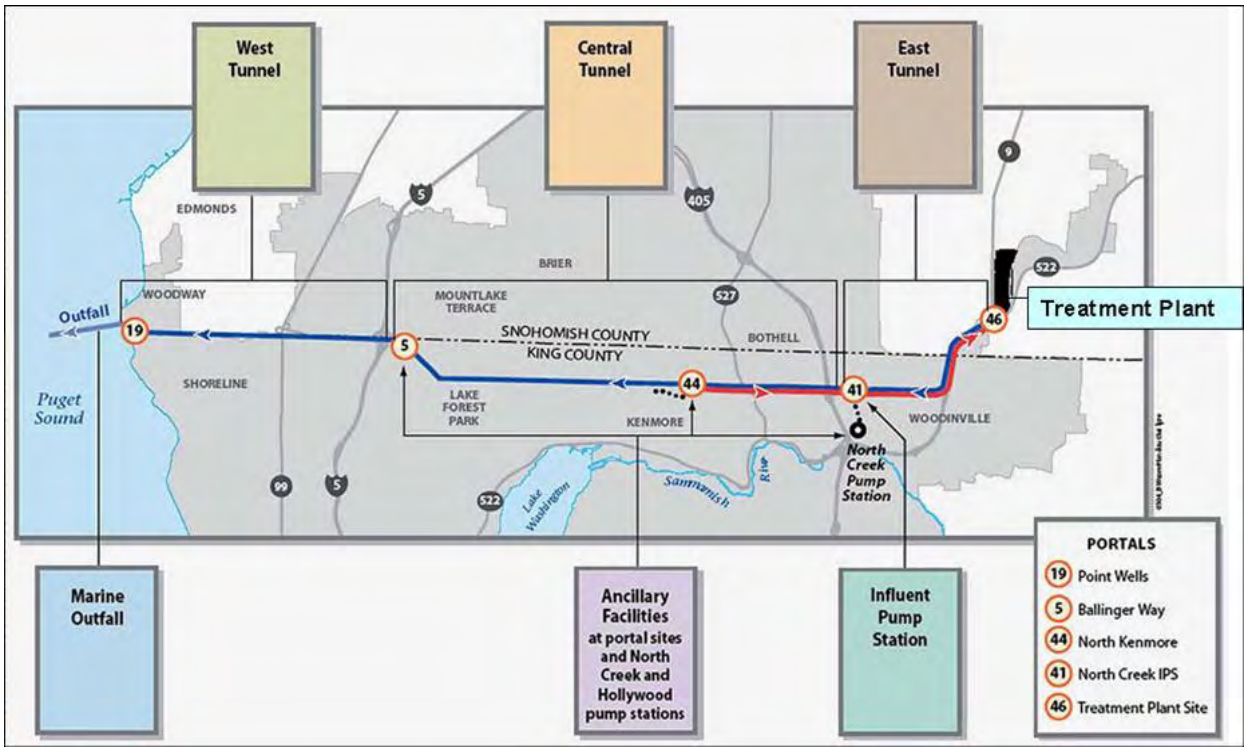


Figure 2-1. Components of the Brightwater System

This chapter summarizes construction, mitigation, and public involvement activities and accomplishments in 2008 related to the Brightwater system. It concludes with a schedule for 2009.

Information on the Brightwater Reclaimed Water System and on the Brightwater cost trend update is provided in Chapters 8 and 9, respectively.

2.1 Brightwater System Construction

The Wastewater Treatment Division (WTD) and its consultants and contractors completed a significant amount of work on the Brightwater project in 2008. Treatment plant and conveyance system construction accomplishments are summarized below.

2.1.1 Treatment Plant Construction

The 114-acre Brightwater Treatment Plant site is located in unincorporated Snohomish County east of State Route 9 (SR-9) and just north of the intersection of SR-9 and SR-522. Treatment and support facilities will cover approximately 43 acres.

Highlights of progress made in 2008 on these facilities are as follows:

- Completed site excavation and earthwork in preparation for tank and gallery foundations
- Completed concrete foundation bottom slabs and started walls for the grit, headworks, primary clarifiers, aeration basins, and galleries
- Completed foundations and started rebar installation and concrete work for the digesters and the Energy and Solids Building
- Installed underground utilities, piping for processes, and conduit for electrical and instrumentation control wiring
- Completed software graphical development for the treatment plant supervisory control system.

Figure 2-2 shows examples of the progress made at the treatment plant site in 2008.

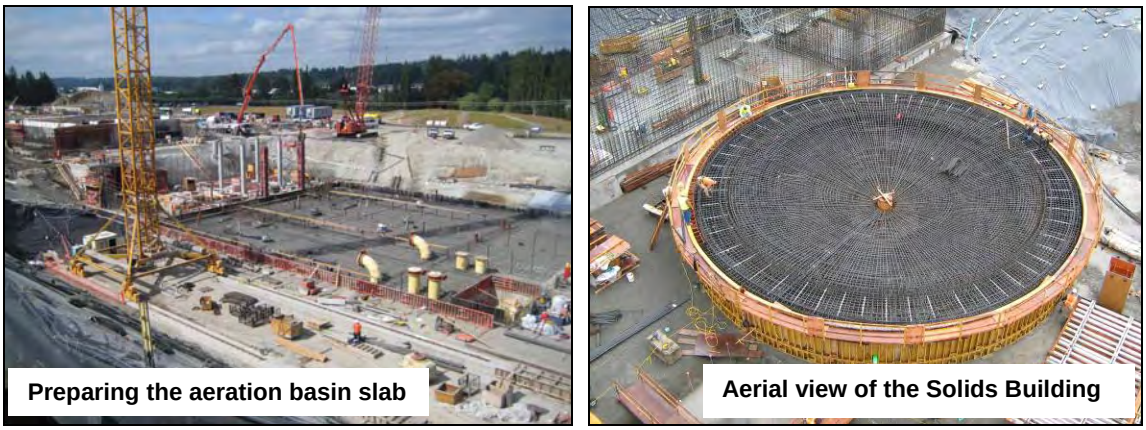


Figure 2-2. Construction at Brightwater Treatment Plant Site

More information on the Brightwater Treatment Plant is available at http://www.kingcounty.gov/environment/wtd/Construction/North/Brightwater/Activities/Construction/Treatment-Plant.aspx.

2.1.2 Conveyance System Construction

The Brightwater conveyance system consists of pipes and facilities that will bring wastewater to and from the treatment plant, including a marine outfall where treated wastewater will be discharged to Puget Sound. The system is being built almost entirely below ground in tunnels 40 to 400 feet deep. Five shafts, called portals, provide access to and from the tunnels for workers and tunnel boring machines (TBMs).

Construction of the conveyance system is divided into six major components: the East Tunnel, Central Tunnel, West Tunnel, Influent Pump Station, Marine Outfall, and Ancillary Facilities (Figure 2-1).

Highlights of accomplishments in 2008 for each component are presented in the following sections.

More information on Brightwater conveyance system construction is available at http://www.kingcounty.gov/environment/wtd/Construction/North/Brightwater/Activities/Construction.aspx.

East Tunnel

The East Tunnel, or Brightwater Tunnel-1 (BT-1), consists of about 14,050 feet of 16.6-foot internal-diameter tunnel between the North Creek Portal in Bothell and the Brightwater Treatment Plant. The BT-1 TBM was launched from the North Creek Portal in September 2007, and excavation of the tunnel was completed in November 2008 (Figure 2-3). Remaining work to be completed includes installing four pipelines in the tunnel and filling the tunnel interior with concrete.

Figure 2-3. Tunnel Boring Machine Emerging at Brightwater Treatment Plant Site

Central Tunnel

The Central Tunnel consists of two 14.4-foot-internal-diameter tunnels: the eastbound and westbound tunnels.

The eastbound tunnel (BT-2) is 11,600 feet long, extending from the North Kenmore Portal to the North Creek Portal in Bothell. The BT-2 TBM was launched in September 2007. Approximately 56 percent (6,502 feet) of the tunneling was completed by the end of December 2008 (Figure 2-4).

The westbound tunnel (BT-3) is 20,100 feet long, extending from the North Kenmore Portal to the Ballinger Way Portal in Shoreline. The BT-3 TBM was launched in March 2008. Approximately 26 percent of the tunneling was completed (5,136 feet) by the end of the year.

Excavation of the Ballinger Way portal shaft was completed in summer 2008, and activities associated with lining the shaft continued through the remainder of the year. Construction of the Ballinger Way Portal is expected to be complete in early 2009.

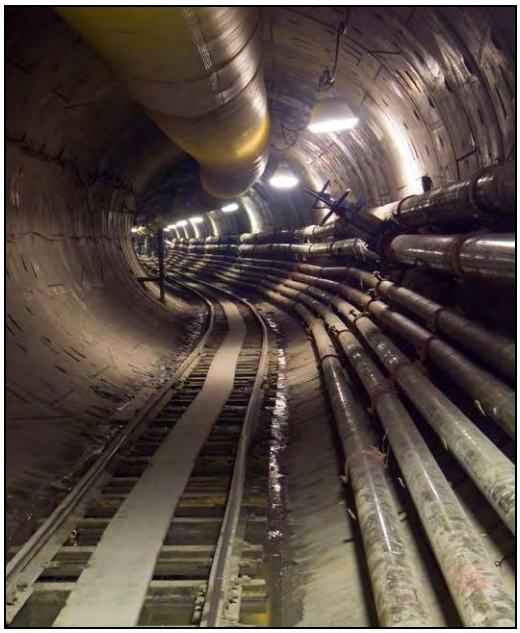


Figure 2-4. Brightwater Tunnel-2

Progress on the Central Tunnel has gone slower than anticipated because of underground conditions. WTD is working with the contractors to develop alternatives to minimize potential systemwide impacts due to delays in the Central Tunnel schedule.

West Tunnel

The West Tunnel (BT-4) consists of 21,200 feet of 12-foot internal-diameter tunnel starting at the Point Wells Portal (Figure 2-5) in unincorporated Snohomish County and heading east to the Ballinger Way Portal in Shoreline. As part of the West Tunnel work, the 550 feet of 60-inch-diameter pipeline connecting the tunnel to the marine outfall was completed in the spring of 2008. This pipeline is also referred to as the marine outfall connector. The BT-4 TBM was launched in September 2008. Approximately 14 percent (2,900 feet) of the tunneling was completed by the end of the year.

Figure 2-5. Point Wells Portal

Marine Outfall

Construction of the marine outfall began in spring 2008 and was completed in December 2008. The 5,400-foot outfall extends from the end of the marine outfall connector to a depth of 600 feet in Puget Sound. The outfall begins onshore with 420 feet of 80-inch-diameter polyurethane coated and lined steel pipe. At approximately 80 feet of depth a Y-shaped segment splits the flow between two 63-inch-diameter concrete-weighted high density polyethylene pipes. The end of each outfall pipe consists of a 250-foot-long diffuser section designed to disperse effluent into Puget Sound.

The outfall pipes were assembled at a staging area in the Snohomish River at the Port of Everett and were towed 17-nautical-miles by tug boats to Point Wells (Figure 2-6). Workers attached the pipes to onshore connectors, lowered them in a controlled submergence 600 feet to the bottom of the Puget Sound, and then backfilled and removed sheet piles at the near-shore trench.

Figure 2-6. Towing of the Outfall Pipes

Influent Pump Station

The Influent Pump Station, located at the North Creek Portal, is designed to pump up to 130 mgd of wastewater to the Brightwater Treatment Plant. The pump station will be largely underground; odor control and other facilities at this site will be aboveground. Site preparation began in 2008. Completion of the pump station is scheduled for 2011.

Ancillary Facilities

Ancillary facilities are being constructed to incorporate Brightwater into the county's regional conveyance system. In 2008, odor control equipment, new generators, and electrical panels were installed at the Hollywood Pump Station; work began on the odor control facility at the North Creek Pump Station; and final design was under way on the North Kenmore and Ballinger Way odor control facilities.

2.2 Mitigation Activities

Mitigation refers to the various measures taken to address construction and operational impacts in communities that host a disruptive regional project. To address the possible impacts of Brightwater construction and operation and to comply with RWSP environmental mitigation policies, WTD has negotiated mitigation agreements with cities, tribal governments, jurisdictions, and local utilities. Some of the mitigation measures address the short-term impacts of construction; other measures are intended to cover longer-term impacts. Examples of mitigation measures include funding mitigation to address traffic impacts on local roadways, installing additional landscape plantings to buffer views, transferring land to local communities for public parkland after Brightwater construction is completed, and restoring salmon habitat. Highlights of progress made in 2008 on Brightwater systemwide mitigation are as follows:

- The City of Shoreline completed design of the Richmond Beach Pump Station Community Park.
- Snohomish County designed safety improvements for streets surrounding the treatment plant site.
- King County transmitted the final mitigation payment of $16 million to Snohomish County according to the Settlement Agreement.
- All conditions of the City of Woodinville mitigation agreement were met, and the county transmitted $1.9 million to the city.
- Brightwater received $275,000 in state grant funds to complete design of the Energy Technology Demonstration Facility and construct the Environmental Education/Community Center (EECC) outreach and storage space.
- Contracts were awarded to Washington State nurseries to provide plant materials for the treatment plant site landscape.

A summary of the Brightwater systemwide mitigation package is available at http://your.kingcounty.gov/dnrp/library/wastewater/wtd/construction/brightwater/docs/MID-doc-0601.pdf.

2.3 Public Involvement Activities

King County places a high priority on involving affected residents and businesses and interested parties in the Brightwater project. Brightwater project staff continues to engage interested parties and keep them informed about construction-related activities, provide informational booths at community events, and hold events in the North Habitat Area at the treatment plant site.

Examples of public involvement activities in 2008 are as follows:

- **North Habitat Area events.** In May, community members were given the opportunity to tour the trails, native plant species, rebuilt stream corridors, and emerging wetlands habitat of the North Habitat Area. More than 50 people participated in the North Habitat Area tours.

  In October, the county hosted an educational event for 160 students from the Lake Washington and Northshore School Districts. The students explored forest ecology, identified and catalogued freshwater insects, and tested water and soil samples. The event was organized by the county and Friends of the Hidden River, a community group of local teachers who have played an integral role in planning and securing funds for the EECC.

- **Construction site tours.** In 2008, Metropolitan Water Pollution Abatement Advisory Committee members and national and international visitors had the opportunity to view the progress of Brightwater construction and learn more about the project.

- **Information booths.** Brightwater staff set up information booths at community events, including the Richmond Beach Strawberry Festival, the Celebrate Woodinville event, and the Ballinger Neighborhood Walk and Fitness Fair.
- **Bulletins, newsletters, news releases, and responses to questions.** The Brightwater project team continued to respond to questions and comments from jurisdictions, neighbors, and the general public. In addition, the team produced newsletters, bulletins, and news releases and updated the Brightwater Web page to keep people informed about project activities.

2.4 Schedule for 2009

Activities anticipated in 2009 for the Brightwater Treatment System are as follows:

- Accept delivery of process control equipment
- Complete construction of the electrical substation at the treatment plant site
- Complete most of the structural concrete work for the liquids, solids, and odor control process areas at the treatment plant and continue installation of mechanical and electrical systems in these areas
- Begin construction of the EECC
- Continue work on landscape areas at the treatment plant site
- Complete East Tunnel (BT-1) pipe installation
- Complete construction of the Ballinger Way Portal shaft
- Continue tunneling the Central Tunnel's eastbound tunnel (BT-2)
- Continue tunneling the Central Tunnel's westbound tunnel (BT-3)
- Continue tunneling the West Tunnel (BT-4)
- Begin construction of the Influent Pump Station
- Complete construction of ancillary facilities at the North Creek Pump Station.

Chapter 3

Conveyance System Improvements

The RWSP calls for improvements to King County's wastewater conveyance system. RWSP conveyance policies direct WTD to use the 20-year peak flow storm as the design standard for its separated wastewater system to avoid sanitary sewer overflows and ensure there is sufficient capacity in the regional conveyance system to accommodate projected population growth.[1] Because no uniform capacity standard was in place before adoption of the RWSP, portions of the regional conveyance system do not currently meet the design standard. In setting this standard, the King County Executive and King County Council recognized that it is one of the most stringent standards in the nation and that it would take some time for the conveyance system to be upgraded to meet this standard.

This chapter begins with a description of the amendments made to RWSP conveyance policies in 2008 and then presents information on the RWSP conveyance projects that were in design or construction in 2008. The chapter concludes with major activities anticipated in 2009 as part of the Conveyance System Improvement (CSI) Program.

3.1 Amendments to RWSP Conveyance Policies

The June 2007 Conveyance System Improvement Program Update identifies regional conveyance projects to meet projected capacity needs through 2050.[2, 3] During the update process, King County worked closely with the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC), through its Engineering and Planning (E&P) Subcommittee, and with individual local agencies.

In recognition of the fact that long-term management of the conveyance system is expensive and largely depends on projections of future flow volumes that are themselves based on projections of regional growth and weather patterns, the update made several recommendations related to future conveyance planning. In November 2007, the King County Executive forwarded these recommendations to the King County Council as amendments to RWSP conveyance policies.

[1] The separated system is the part of the King County regional system where stormwater and wastewater are collected in separate pipes.

[2] The 2007 *Conveyance System Improvement Program Update* is available at http://www.kingcounty.gov/environment/wastewater/CSI/ProgramUpdate.aspx.

[3] RWSP Wastewater Planning Policy-4 calls for facility sizing to take into account the need to accommodate build-out population. By 2050, it is projected that the regional wastewater service area will be fully built out and all sewerable portions of the service area will be connected into the wastewater system. Therefore, new conveyance facilities are designed to convey the 20-year peak flow event projected to occur in 2050.

The King County Council approved the policy amendments through adoption of Ordinance 16033 in March 2008.[4]

Key elements of the adopted conveyance policy amendments are as follows:

- Update the CSI program every five years beginning in 2013 to ensure that the program remains current.
- Conduct systemwide flow monitoring every 10 years that corresponds with the population census to ensure that flow projections remain accurate.
- To avoid overbuilding the system, field verify wastewater flows and conveyance facility conditions prior to implementing regional conveyance capital projects that are intended to expand the capacity of the conveyance system.
- Evaluate other demand management methods to meet identified conveyance needs, such as infiltration and inflow reduction, water conservation, and reclaimed water facilities.

3.2 RWSP Projects in Design

Two RWSP conveyance projects were in design during 2008: the Kent/Auburn Conveyance System Improvements and the Black Diamond Infrastructure Upgrade. The locations of these projects are shown in Figure 3-1.

3.2.1 Kent/Auburn Conveyance System Improvements

The Kent/Auburn Conveyance System Improvements project will provide needed capacity in the rapidly growing south portion of King County's wastewater service area by adding approximately 3 miles of pipes in Auburn, Kent, Algona, and Pacific. The project consists of four individual projects that will be built in two phases: Phase A and Phase B. Phase A projects are expected to be in service in 2011, and Phase B projects are expected to be in service in 2015.

Phase A projects consist of two new pipelines:

- **Stuck River Trunk in Auburn.** Approximately 3,900 feet of new 27-inch-diameter gravity sewer pipe will be constructed to divert flows upstream of the M Street Trunk to the Lakeland Hills Trunk.
- **Kent East Hill Diversion in Kent.** Approximately 1,800 feet of new 24-inch-diameter gravity sewer pipe will be constructed to divert flows from the Mill Creek Interceptor to the South 277th Street Interceptor.

[4] Ordinance 16033 is available at http://mkcclegisearch.kingcounty.gov/attachments/29221.pdf.

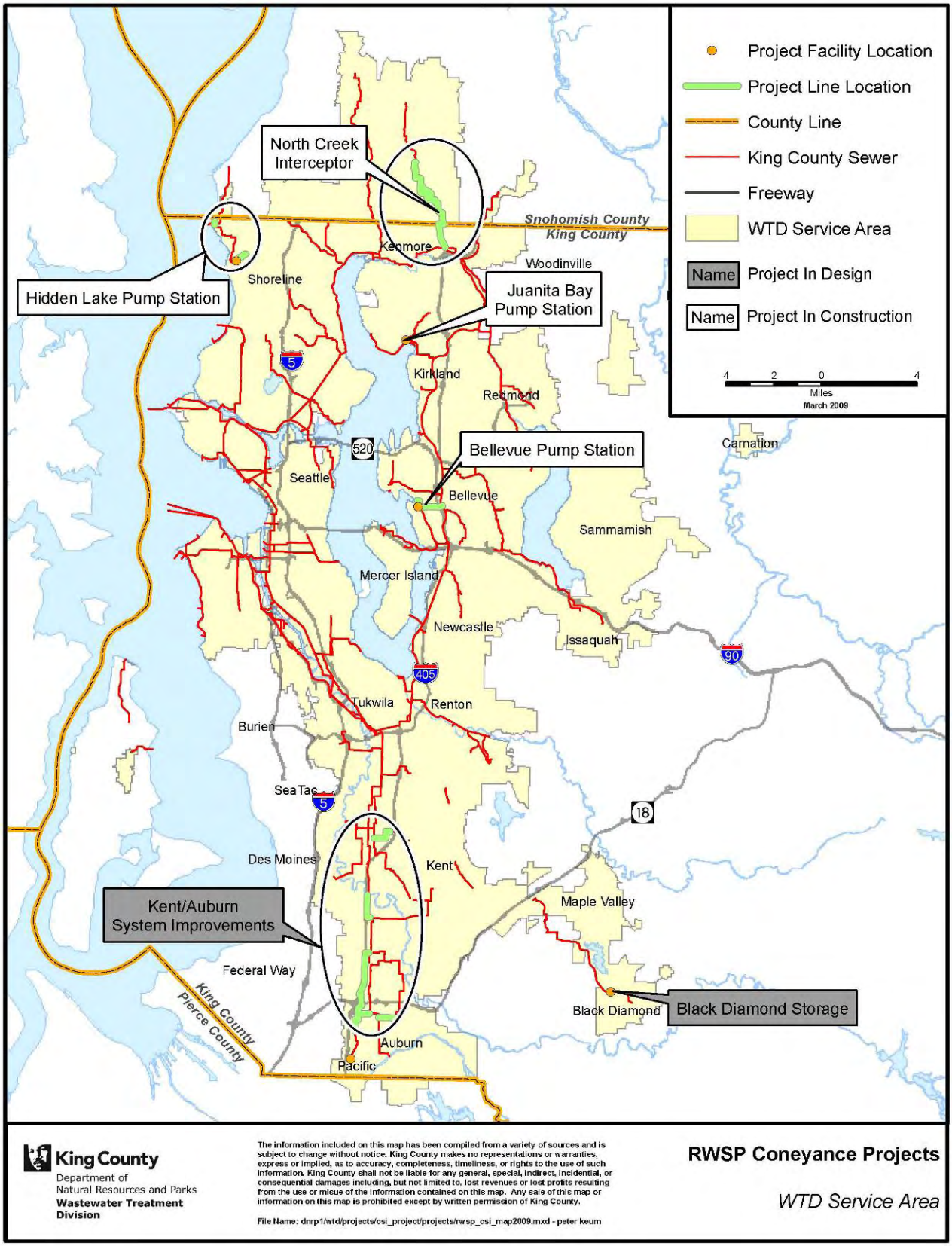


Figure 3-1. RWSP Conveyance Projects in Design and Construction in 2008

Phase B projects consist of two new pipelines:

- **Pacific Pump Station Discharge in Pacific, Algona, and Auburn.** Approximately 7,900 feet of new pipe will carry flow north from the Pacific Pump Station to the Auburn West Interceptor.
- **Auburn West Interceptor Parallel in Auburn.** Approximately 2,600 feet of new gravity pipe will parallel an existing portion of the Auburn West Interceptor between 15th Street Southwest and West Main Street.

Phase A project activities in 2008 focused on selecting the preferred alignments, completing predesign, and starting final design. Environmental review of Phase A projects also took place in 2008. Through this review, the county determined that the Phase A projects will not have significant adverse environmental impacts and issued an environmental determination of non-significance (DNS) in September 2008. Final design will continue through 2009, and construction on Phase A projects is expected to begin in 2010.

Phase B project activities in 2008 focused on selecting the preferred alignments, completing predesign, and beginning easement acquisitions. Final design is expected to be complete in 2012. Construction on Phase B projects is expected to begin in 2013.

To help identify preferred project elements and their locations, WTD staff met with interested parties, large property owners, and staff from the Cities of Auburn, Kent, Algona, and Pacific. The project team will continue to work with local jurisdictions, regulatory agencies, property owners, and neighbors during design and construction.

Visit the project Web site for more information:
http://www.kingcounty.gov/environment/wtd/Construction/South/KentAuburn.aspx.

3.2.2 Black Diamond Infrastructure Upgrade

Population in the City of Black Diamond is projected to reach approximately 20,000 residents by 2025, based on current local master planned developments (MPD) planning. As the city's wastewater conveyance and treatment provider, King County must build conveyance capacity to manage and transport wastewater flows from Black Diamond.

The county and the city have agreed to a phased approach to providing additional conveyance capacity:

- **First Phase.** An enclosed peak-flow equalization storage facility will be built in the first phase. The facility will store peak flows entering the pump station in Black Diamond and release them slowly over time to avoid overwhelming the downstream conveyance system. It will extend the life of existing equipment and defer the need to build additional new pumping and conveyance facilities for several years. Based on current MPD planning, the facility is anticipated to be online by 2015.
- **Second Phase.** Improvements in the second phase could include larger conveyance facilities, a satellite treatment facility, or a combination of both. Second-phase facilities are currently projected to be operating by 2020. A final decision will be made only after

extensive planning and analysis. Planning will incorporate outcomes from development of the first-phase storage facility and the Reclaimed Water Comprehensive Plan (see Chapter 8).

Activities in 2008 focused on developing and selecting sites and configuration alternatives, researching property issues, and conducting an environmental review for the first-phase storage facility. Public meetings were held in April and May 2008 for Black Diamond community members and interested parties. A formal alternatives analysis report is expected to be complete in early 2009; the report will reflect input gathered from the City of Black Diamond and the public. No additional work on the project is planned for 2009.

Visit the project Web site for more information:
http://www.kingcounty.gov/environment/wtd/Construction/South/BlackDiamond.aspx.

3.3 RWSP Projects in Construction

Four RWSP conveyance projects were in construction during 2008: the Hidden Lake Pump Station Replacement and Sewer Improvement, Juanita Bay Pump Station Replacement, North Creek Interceptor, and Bellevue Pump Station Upgrade. The locations of these projects are shown in Figure 3-1.

3.3.1 Hidden Lake Pump Station Replacement and Sewer Improvement

The Hidden Lake Pump Station Replacement and Sewer Improvement project includes constructing a new Hidden Lake Pump Station to replace the existing pump station in the City of Shoreline, replacing approximately 12,000 feet of the Boeing Creek Trunk, and building a 500,000-gallon underground storage facility in Boeing Creek Park. The new pump station has a pumping capacity of 6.8 million gallons per day (mgd), an increase of 2.5 mgd over the replaced pump station's capacity of 4.3 mgd. The county also replaced 6,000 feet of water mains owned by Seattle Public Utilities and 1,200 feet of local sewer pipes for the Ronald Wastewater District as part of the project.

WTD staff coordinated with the City of Shoreline, Ronald Wastewater District, and the City of Seattle to minimize community impacts. This coordination made it possible to keep the Boeing Creek and Richmond Beach parks open during construction. WTD staff also worked closely with nearby residents and businesses and with City of Shoreline staff to keep them informed of construction activities. The new pump station, designed with the help of public input, fits in the neighborhood and includes native plant landscaping.

Activities in 2008 focused on completing construction and startup of the pump station and Boeing Creek Trunk. Construction closeout is expected to be complete in early 2009. Because this project is considered complete, this is the last year it will be included in the RWSP annual report.

Visit the project Web site for more information:
http://www.kingcounty.gov/environment/wtd/Construction/North/HiddenLake.aspx.

3.3.2 Juanita Bay Pump Station Replacement

The Juanita Bay Pump Station Replacement project replaces the aging 14.2-mgd Juanita Bay Pump Station with a 30.6-mgd pump station. The new pump station is designed to meet projected flows through 2050. It includes features to improve safety and reliability, such as a standby generator, odor and corrosion prevention systems, improved access for maintenance vehicles and workers, and equipment lifting devices.

Construction on the project was substantially complete by the end of 2008, and the new pump station began operating in January 2009. Because this project is considered complete, this is the last year it will be included in the RWSP annual report.

Visit the project Web site for more information:
http://www.kingcounty.gov/environment/wtd/Construction/East/JuanitaBay.aspx

3.3.3 North Creek Interceptor

Improvements to the North Creek Interceptor are necessary to avoid overflows and meet current and future growth needs in the North Creek basin. This project, located in unincorporated Snohomish County and the City of Bothell, includes constructing 16,400 feet of gravity sewer pipes, ranging from 21 to 48 inches in diameter, to replace existing sewer pipes. The project will be constructed under two contracts: one for the North Segment located in Snohomish County and one for the South Segment located in the City of Bothell.

In 2005, King County signed an interlocal agreement with the Alderwood Water and Wastewater District. The district is managing design and construction of the project. WTD staff is providing overall project management and oversight, including approving key construction decisions.

In 2008, activities focused on completing final design and beginning construction on both the North and South Segments. Construction is expected to be complete in 2012.

3.3.4 Bellevue Pump Station Upgrade

The Bellevue Pump Station is being upgraded to handle growing wastewater flows from the Bellevue area. Built in 1964, the station pumps about 8 mgd of wastewater to the Sweyolocken Pump Station near the Mercer Slough.

This project will increase the Bellevue Pump Station's firm capacity to 11 mgd and will improve the station's electrical and control systems.[5] Because of space constraints, the Sweyolocken Pump Station could not be upgraded to handle these additional flows, so a new 5,300-foot-long,

[5] Firm capacity means the capacity of the pump station with one of the larger pumps out of service for maintenance or repair needs.

24-inch-diameter force main was constructed in 2008 to convey the added flows directly from the upgraded Bellevue Pump Station to the East Side Interceptor.

Pump station improvements include new pumps; new electrical, mechanical, and odor control equipment; a new standby generator; new aboveground facilities to house the new equipment; and better access for maintenance vehicles and workers. The project is being implemented through two construction contracts: one for the force main and one for the pump station. The force main construction contract was completed and closed in 2008. The pump station contract was advertised in spring, a contractor was selected in summer, and construction began in fall 2008. Construction is expected to be complete in 2010.

WTD continues to update City of Bellevue staff, community groups, and affected property owners on project progress and milestones through a project Web site and a 24-hour community inquiry hotline.

Visit the project Web site for more information:
http://www.kingcounty.gov/environment/wtd/Construction/East/Bellevue.aspx.

3.4 Schedule for 2009

CSI activities scheduled for 2009 are as follows:

- Complete final design of the Phase A projects (Stuck River Trunk in Auburn and the Kent East Hill Diversion in Kent) of the Kent/Auburn Conveyance System Improvements project
- Complete the alternatives analysis report for the Black Diamond storage facility
- Continue construction of the North Creek Interceptor
- Continue construction of the Bellevue Pump Station Upgrade project.

Project development activities will begin in 2009 on three projects identified in the June 2007 CSI program update:

- **Bellevue Influent Trunk Improvements**. This project, located in the City of Bellevue, will provide additional capacity to approximately 1,600 feet of the existing Bellevue Influent Trunk to meet the 20-year peak flow design standard. The trunk conveys flows to the Bellevue Pump Station.
- **Sunset/Heathfield Pump Station Replacement and Force Main Upgrade**. This project, located in the City of Bellevue will either modify or replace the existing Sunset and Heathfield Pump Stations and their associated force mains to increase peak capacity to meet the 20-year peak flow design standard and future growth needs in the South Sammamish Basin.
- **Decennial Flow Monitoring.** This project is being carried out in accordance with RWSP conveyance policy. The policy directs WTD to conduct systemwide flow monitoring every 10 years to correspond with the population census. In fall 2009, approximately

225 flow meters will be installed throughout the separated portion of the service area to collect accurate flow data over two wet seasons. The data collected will be used to verify and update the regional conveyance system improvement needs identified in the June 2007 CSI Program Update and to prepare for the next CSI Program Update, anticipated to be completed in 2013.

Chapter 4

Infiltration and Inflow Control

The RWSP calls for improvements to reduce existing and future levels of infiltration and inflow (I/I) into local collection systems. I/I is clean stormwater and groundwater that enter the sewer system through cracked pipes, leaky manholes, or improperly connected storm drains, down spouts, and sump pumps. Most inflow comes from stormwater and most infiltration comes from groundwater (Figure 4-1). I/I affects the size of King County conveyance and treatment systems and, ultimately, the rate that businesses and residents pay to operate and maintain them.

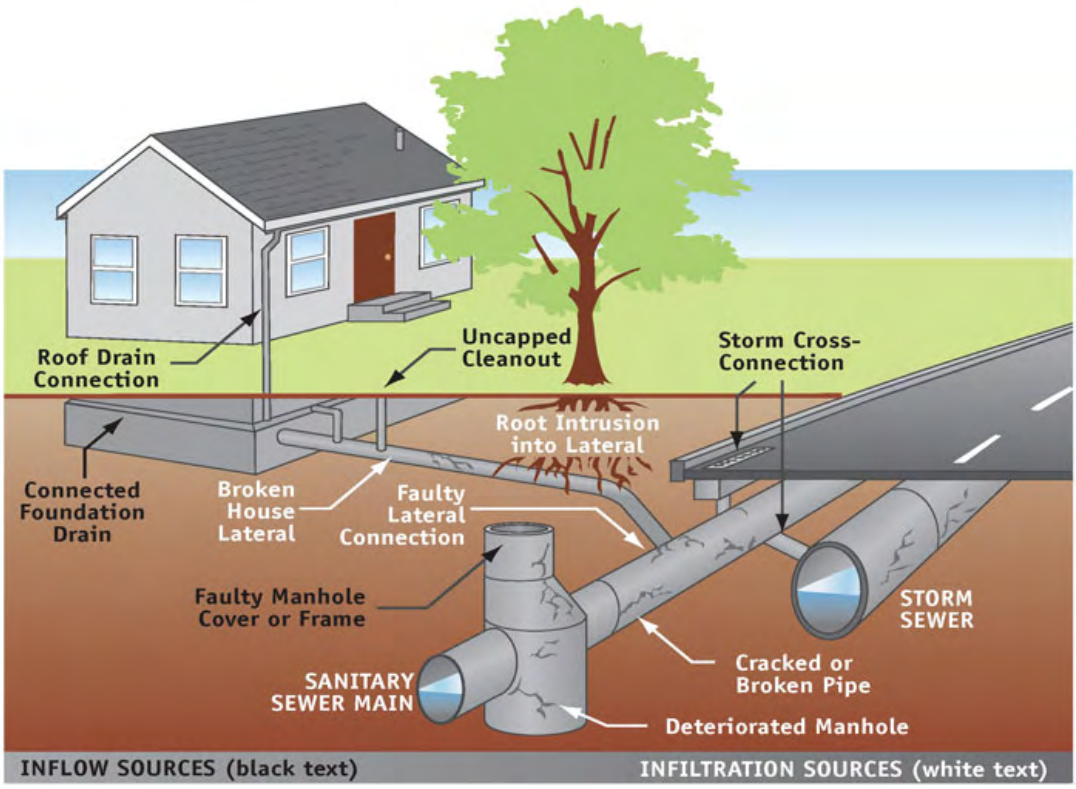


Figure 4-1. Sources of Infiltration and Inflow

In 2008, the I/I control program continued efforts to implement the Executive's Recommended Regional Infiltration and Inflow Control Program that was approved in May 2006 by the King County Council through Motion 12292.[1] The recommended program calls for the county and the local agencies to select, implement, and evaluate two or three "initial" I/I reduction projects to test the effectiveness of I/I reduction on a larger scale than the pilot projects that were completed

[1] The Executive's Recommended Regional Infiltration and Inflow Control Program report is available at http://www.kingcounty.gov/environment/wastewater/II/Resources/Reports/ExecutiveRecommendation.aspx.

in 2004.[2] A primary goal of the initial projects is to determine whether and under what conditions it is possible to cost-effectively remove enough I/I from the collection system to delay, reduce, or eliminate a planned regional conveyance system improvement project.

This chapter describes the progress made in 2008 to implement the initial I/I reduction projects and the overall schedule to complete the projects.

4.1 Initial I/I Reduction Project Progress

Efforts in 2008 focused on completing alternatives analysis within the four candidate project areas located in the Cities of Bellevue, Issaquah, and Renton, and in the Skyway Water and Sewer District (Figure 4-2). Elements of the alternatives analysis included sewer system evaluation survey work, flow monitoring during the 2007–2008 wet season, geotechnical and environmental field assessments, and development of I/I rehabilitation (sewer repair) cost estimates. The county's Wastewater Treatment Division (WTD) carried out these efforts in cooperation with the host agencies.

Figure 4-2. Candidate Areas for Initial I/I Reduction Projects

[2] The purpose of the pilot projects was to evaluate the effectiveness of various rehabilitation techniques. Details on the pilot projects are available at http://www.kingcounty.gov/environment/wastewater/II/Resources/Reports/PilotProject.aspx.

Results from these efforts were used to evaluate the feasibility and cost-effectiveness of I/I reduction in the candidate project areas. WTD presented the results to the Engineering and Planning Subcommittee of the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) in September 2008. In consultation with MWPAAC and the host agencies, two projects were selected as the initial I/I reduction projects for final design and construction—a combined Bellevue and Issaquah project and a Skyway project. These projects are described in the following sections.

The details and results of the alternatives analysis and the process to select the final initial I/I reduction projects will be documented in an alternatives analysis report. The report is expected to be available in spring 2009.

4.1.1 Combined Bellevue and Issaquah Initial I/I Reduction Project

The combined Bellevue and Issaquah initial I/I reduction project (Figure 4-3) includes repairing side sewers and laterals associated with 220 properties—107 properties in the Bellevue portion of the project (Basin BEL031) and 113 properties in the Issaquah portion (Basin ISS003). It is anticipated that this project will result in removing 0.85 to 1.04 million gallons per day (mgd) of peak I/I, which would reduce the sizes and costs of two planned RWSP conveyance system improvement projects—the Eastgate Parallel Pipe Storage facility and Issaquah Storage facility.

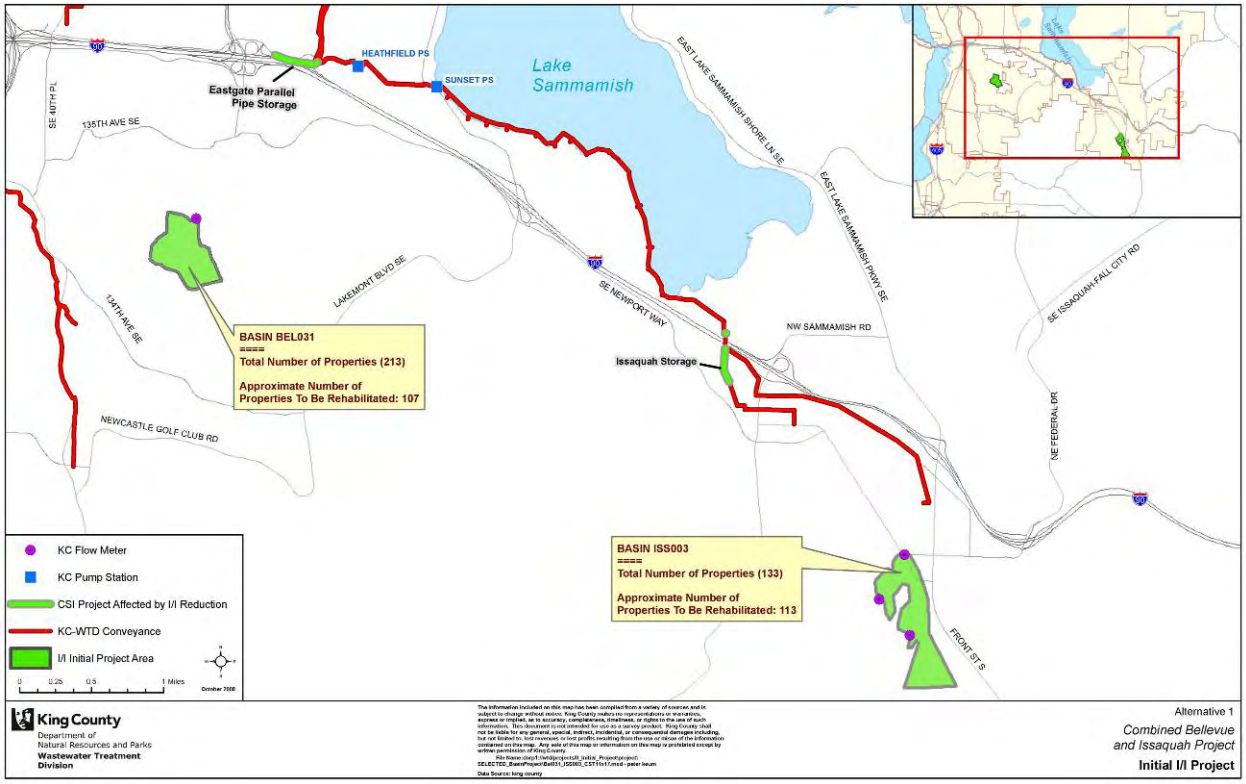


Figure 4-3. Combined Bellevue and Issaquah Initial I/I Reduction Project

4.1.2 Skyway Initial I/I Reduction Project

The Skyway initial I/I reduction project (Figure 4-4) includes repairing side sewers and laterals associated with 340 properties in Basin BLS002. It is anticipated that this project will result in removing 1.8 to 2.2 mgd of peak I/I, which would eliminate the need for one RWSP conveyance system improvement project—the planned Bryn Mawr Storage facility.

To make this I/I initial project cost-effective, the Skyway Water and Sewer District has agreed to fund a portion of the cost of this project. The district may contribute additional funds to add other elements to the project that will benefit its local system.

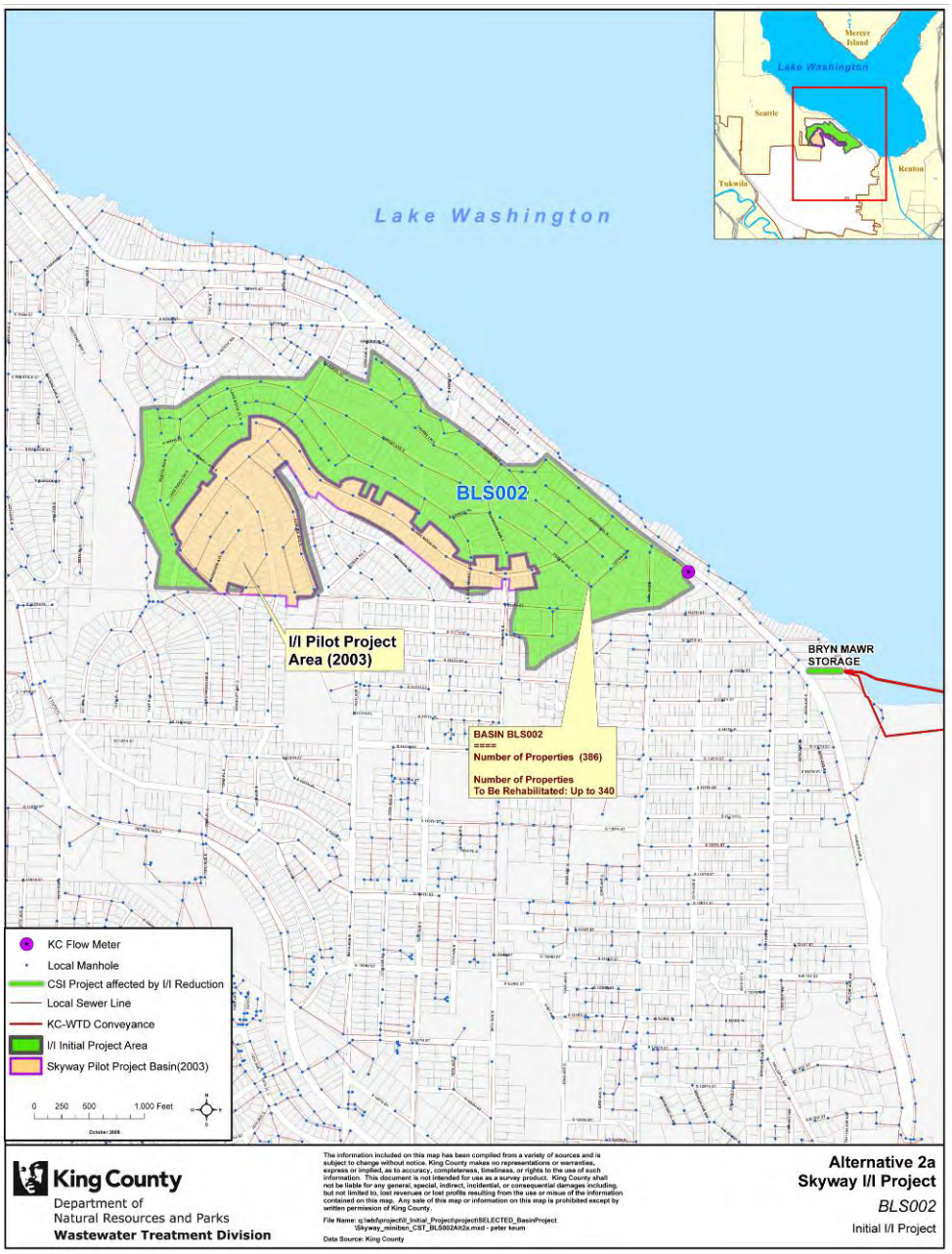


Figure 4-4. Skyway Initial I/I Reduction Project

4.2 Initial I/I Reduction Projects Schedule

Figure 4-5 shows the schedule, including decision points and milestones, for completing final design and construction of the initial I/I reduction projects. Schedule highlights are as follows:

- Predesign on the selected projects will begin in spring 2009 and is expected to be complete in fall 2009.
- Final design on the Skyway project is expected to be complete by the end of 2010. Construction on this project is scheduled to occur in 2011.
- Final design on the combined Bellevue and Issaquah project is expected to be complete in 2011. Construction on this project is expected to occur in 2012.
- Post-project flow monitoring will be conducted in winter of 2012–2013 to evaluate the results of implementing the initial I/I reduction projects.

WTD will continue to work closely with MWPAAC to review project results and develop conclusions and recommendations on long-term I/I reduction and control. The King County Executive is expected to forward recommendations on long-term I/I reduction and control to the King County Council in 2013.

Figure 4-5. Initial I/I Reduction Projects Schedule and Milestones

More information on King County's Regional I/I Control Program can be found at http://www.kingcounty.gov/environment/wastewater/II.aspx.

Chapter 5

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 CSO control. 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, close to half 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 Duwamish Waterway.

This chapter provides information on CSO control and sediment management activities in 2008. The discussions include plans for activities in 2009.

5.1 CSO Control Activities in 2008

Key achievements of the CSO control program in 2008 are as follows:

- Made progress in improving the operation of the Mercer/Elliott West and Henderson/Norfolk CSO control systems
- Completed the 2008 CSO control plan update and started planning and procurement for the 2011 CSO program review
- Continued planning and project development of the Puget Sound Beach projects
- Completed 90 percent design of the Ballard Siphon replacement project, which will control CSOs at the Ballard Regulator Station
- Started Phase 2 of the CSO treatment technology pilot program
- Started evaluating use of green infrastructure technologies as CSO control alternatives
- Continued coordinating with the City of Seattle on CSO and stormwater management
- Responded to a program audit conducted by the U.S. Environmental Protection Agency.

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

5.1.1 Mercer/Elliott West CSO Control System

The Denny Way/Lake Union CSO control project was under way prior to adoption of the RWSP.[2] 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 has now operated through three wet seasons (June through May).[3] 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.

The city and county have made adjustments to improve system operation and are continuing to assess the need for other refinements to address permit compliance issues. 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 (see Chapter 10).

5.1.2 Henderson/Norfolk CSO Control System

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

With completion of this system, all of the county's CSOs along Lake Washington are controlled. Refinements of the Henderson Tunnel, which discharges treated CSOs to the Duwamish Waterway, are under way in order to bring the Norfolk CSO under control. Work to improve the operation of the disinfection system began in 2008 (see Chapter 10).

5.1.3 2008 CSO Control Plan Update and 2011 CSO Program Review

In 2008, the county's Wastewater Treatment Division (WTD) submitted the 2008 CSO plan update to Ecology as part of the West Point Treatment Plant's National Pollutant Discharge Elimination System (NPDES) permit renewal application.[4] Work on the update began in 2006 with a public workshop and continued in 2007 and early 2008 with public outreach and document production activities.

WTD also began planning and procurement for its second CSO program review, scheduled for transmission to the King County Council by the end of 2011. As with the 2006 program review, the purpose of the 2011 review is to prepare for the next CSO control plan update.

[2] The Mercer/Elliot West CSO control system was the outcome of the Denny Way/Lake Union CSO control project.
[3] CSO volumes and frequencies are assessed for the period from June 1 through May 31 each year in order to capture data for a whole wet season.
[4] CSO control plan updates are prepared in conjunction with NPDES permit renewal applications for the West Point Treatment Plant. The permit is renewed about every five years.

The CSO program review will reevaluate the prioritization of RWSP CSO control projects according to their potential to protect human health, the environment, and endangered species, and will consider adjustments to the schedule for completing the projects.

The project priorities put forth in the RWSP and carried forward in the 2008 CSO control plan update 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 2014 (described later in this chapter).[5]
- **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.
- **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 been accomplished in this area prior to adoption of the RWSP. As described later in this

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

[5] The SW Alaska CSO control project, 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.

chapter, the Ballard CSO will now be controlled through the Ballard Siphon replacement project, scheduled for completion in 2012.

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 early 2010 and may lead to changes in sizing, schedules, and costs of CSO control projects.

The 2011 CSO control program review will incorporate information from the recalibrated hydraulic model. The program review will also incorporate information from an assessment of technologies including the results of CSO treatment pilots under way, an evaluation of green stormwater infrastructure as a CSO control alternative, and any new environmental or public health findings with implications for CSO control.

The 2008 CSO control plan update and the 2006 CSO control program review are available at http://www.kingcounty.gov/environment/wastewater/CSO/Library/PlanUpdates.aspx.

5.1.4 Puget Sound Beach Projects

In January 2007, King County initiated the project development and predesign phases 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
- 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 are being held in each of the four project basins.

Flow monitoring in the City of Seattle's sewer system has been 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 stormwater infrastructure will be explored as an alternative for CSO control in one of the basins (see the discussion later in this chapter). 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.

Predesign will continue through 2009 and end with issuance of facility plans in 2010. Washington State low-interest loans were awarded to fund facility plans for all but the South Magnolia project. Construction is expected to begin in late 2013.

More information can be found at http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BeachCSO.aspx.

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 2012—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 specified the use of conventional primary sedimentation for CSO treatment. Since adoption of the RWSP, some technological advances 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 was designed to be completed in three phases:

- **Phase 1 (2007–2008) – Project development, jar testing, and technology identification.** Phase 1 was completed in 2008. After a review and assessment of the adequacy of the operating data elsewhere in the United States of available and developing technologies, the Phase 1 work plan recommended testing of two technologies: chemically enhanced clarification and chemically enhanced clarification with lamella plates (Figure 5-2).[6] These technologies were selected for testing because they have the potential to reduce the footprint and costs of large CSO treatment facilities but pose technical questions that can be evaluated through pilot testing. Testing of these technologies will allow them to be considered side-by-side with other technologies during future full-scale alternatives analyses.
- **Phase 2 (2008–2009) – Pilot-scale testing at a treatment plant.** Phase 2 pilot-scale testing was initiated at the West Point Treatment Plant in late 2008 and is anticipated to continue into the fourth quarter of 2009. The testing is evaluating optimum loading rates and contaminant removal using fabricated CSO water (diluted wastewater) and a variety of chemicals designed to enhance settling of solids.
- **Phase 3 (2009) – Pilot-scale testing at a CSO site, if necessary**. It appears, based on work done to date, that Phase 3 testing will not be necessary.

Figure 5-2. Exterior of the CSO Treatment Pilot Plant (Left) and Lamella Plates (Right)

5.1.7 Evaluation of Green Stormwater Infrastructure

In 2007, the U.S. Environmental Protection Agency (EPA) and other national organizations (National Association of Clean Water Agencies, Natural Resources Defense Council, Low Impact Development Center, and Association of State and Interstate Water Pollution Control Administrators) agreed to promote a set of techniques, technologies, approaches and practices—

[6] Lamella plate technology reduces turbulence, allowing solids to settle more rapidly.

collectively referred to as green stormwater infrastructure (GSI)—as an environmentally preferable approach to wet-weather management.

GSI can be used to eliminate or reduce the amount of water and pollutants that run off a site and ultimately are discharged into adjacent water bodies. It generally refers to systems and practices that use or mimic natural processes to infiltrate, evapotranspirate (to return rainwater to the atmosphere either through evaporation or by plant metabolism), or reuse stormwater or runoff on the site where it is generated. Approaches currently in use include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, porous and permeable pavements, and vegetated median strips. These approaches can be used to keep rainwater out of the sewer system so that it does not contribute to a CSO. They may also provide greater adaptability in responding to potential climate change impacts on wastewater systems.

Following its 2007 agreement, EPA released an action strategy in 2008 for managing wet-weather flows with GSI. In addition, EPA has required a number of agencies across the country to analyze GSI alternatives in their CSO long-term control plans. In response to this national trend, WTD will evaluate the Puget Sound Beach projects and future CSO control projects for opportunities to use GSI.

5.1.8 Coordination with the City of Seattle

Extensive coordination with the City of Seattle, including exchange of rainfall, modeling, flow, and Geographic Information System (GIS) data, continues to occur. The county is providing 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 GSI alternatives for the county's Puget Sound Beach projects. Each agency is participating and will continue to participate in the other's planning processes.

5.1.9 Program Audit

In December 2007, 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 underwent a similar audit at the same time. These audits are being routinely conducted across the country in larger communities with CSOs. The audits sometimes result in consent decrees covering CSO long-term control plans and project schedules. The county expects to receive initial audit findings in spring 2009.

5.2 Sediment Management Activities in 2008

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

[7] CERCLA is commonly known as Superfund.

outfalls that are contaminated with a variety of heavy metals (such as lead, copper, and zinc), phthalates, polychlorinated biphenyls (PCBs), and hydrocarbons.[8] Most of the contamination dates 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; it is likely that not all these CSOs will require sediment cleanup under Superfund.

5.2.1 Sediment Management Plan

The sediment management plan calls for cleanup of the Denny Way, Hanford/Lander, and Chelan CSOs and development of a model to better predict the fate and transport of contamination.[9]

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 October 2007. King County dredged and capped the area in November 2007–February 2008. Dredging occurred over 32 days, removing approximately 14,376 cubic yards (CY) of sediment contaminated with PCBs, hydrocarbons, and mercury (Figure 5-3). A total of 47 pounds of PCBs were removed from the environment. The excavated area was then backfilled over a 26-day period with approximately 19,460 CY of clean sand, armor rock, and habitat-enhancing gravel. In April 2008, the county began a 10-year program to monitor sediment quality at the site. After completion of five years of monitoring, the county will evaluate alternatives for cleaning up nearby areas.

The model to better predict deposition of contaminants around CSO outfalls will be ready in 2009. 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://www.kingcounty.gov/environment/wastewater/SedimentManagement.aspx.

[8] The sediment management plan is available at http://www.kingcounty.gov/environment/wastewater/SedimentManagement/ManagementPlan.aspx.
[9] The Hanford/Lander and Chelan CSOs are discussed under "Harbor Island Superfund Site."

Figure 5-3. Dredging of Contaminated Sediments at the Old Denny Way CSO Site

5.2.2 Harbor Island Superfund Site

The Harbor Island Superfund site is divided into the West Waterway Operable Unit and East Waterway Operable Unit. In 2003, EPA issued a Record of Decision stating that no remedial action is necessary in the West Waterway, which includes sediment near the Chelan CSO. No future cleanup is anticipated at this CSO. The county continues to monitor the location.

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 East Waterway. Work on the site began in 2007 after EPA approved the scope of the remedial investigation and feasibility study. In 2008, dredging began in front of Terminal 30 near the county's Lander CSO; 20,000 CY of contaminated sediment will be removed and disposed of at an upland facility. The Lander project will be completed in 2009.

In 2008, the King County Industrial Waste Program (KCIW) began planning and implementing source control activities, including business inspections and sampling, in order to supplement available chemistry data on the Hanford and Lander CSOs. The program also collected samples of stormwater runoff to assess potential PCB concentrations in stormwater that enters the combined sewers from the south end of the old Rainier Brewery site that drains to the East Waterway (see Chapter 10).

5.2.3 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. King County 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 and feasibility study for the Lower Duwamish Waterway Superfund site. The draft remedial investigation, which defines the extent and inherent risks of contamination, was completed in 2008 and is expected to be finalized in 2009. The work that began on the draft feasibility study in 2008, 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 (part of the sediment management plan) and the Slip 4 CSO—to clean up portions of the waterway earlier than required.[10] 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 is providing critical information that can be used for determining cleanup alternatives for the entire Superfund site.[11] In early 2007, source control sampling from areas upland of 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 after 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. KCIW participates in this work group and has collected and analyzed industrial waste discharge and rainfall samples for contaminants, such as phthalates, found in the cleanup area. In 2008, the program published final reports on its findings (see Chapter 10).

Visit the Duwamish Waterway Programs Web site for more information:
http://www.kingcounty.gov/environment/wastewater/DuwamishWaterway.aspx.

[10] The Slip 4 cleanup is being managed by the City of Seattle. King County is partnering with the city on this effort. WTD serves as the county's lead agency on behalf of WTD and the King County International Airport/Boeing Field.
[11] Diagonal/Duwamish project documents can be found at http://www.kingcounty.gov/environment/wastewater/SedimentManagement/Projects/DuDi/Library.aspx#Closure.

Chapter 6

Odor Control Program

The RWSP includes policies to guide King County in achieving its goal of preventing and controlling nuisance odor occurrences at all wastewater treatment plants and associated conveyance facilities. To achieve this goal, the policies provide direction on implementing an odor prevention program that goes beyond traditional odor control. RWSP reporting policies call for including in the annual reports a status of the odor prevention program and a summary of odor complaints.

This chapter presents a status report as of December 2008 on the implementation of odor control improvements at the West Point and South Treatment Plants, the odor control improvements planned for conveyance system facilities, and the odor control design planned for the Brightwater System. The discussions include plans for odor control activities in 2009. Appendix A provides a summary of odor complaints received in 2008.

More information on WTD's odor control program is available on the Web: http://www.kingcounty.gov/environment/wtd/Response/OdorControl/GoodNeighbor.aspx.

6.1 Phased Retrofit of the West Point and South Plants

The RWSP odor control policies require that odor control retrofits be phased at the West Point and South Treatment Plants, implementing those that generate the greatest improvements first. To that end, the Wastewater Treatment Division (WTD) has undertaken projects at each plant to identify and implement changes to existing odor control systems and to install new systems.

At the West Point plant, efforts in 2008 focused on evaluating the odor control improvements that were completed in 2007 (covering the division channel and modifying the odor scrubber system). The evaluation found that the odor intensity from these areas was reduced by 79 percent (target reduction was 81 percent) and that odor frequency was reduced by 81 percent (target reduction was 90 percent). To improve these results, the following operational activities were implemented in 2008:

- Increasing odor monitoring at the fence line
- Cleaning process tanks more frequently
- Optimizing chlorination of plant influent
- Providing additional treatment of secondary sedimentation tank mixed liquor lines
- Monitoring influent for dissolved sulfide.

Results of these activities will be evaluated in 2009 and 2010.

At South plant, efforts in 2008 focused on evaluating the odor control improvements that were completed in 2007 (installation of the covers for each first pass of the four aeration basins and of covers for the return activated sludge channel). Preliminary modeling results indicate that the intensity of maximum odor impact was reduced by 91 percent (target reduction was 99 percent) and that the frequency of impacts was reduced by 76 percent (target reduction was 96 percent). Operational activities to help improve these results, such as more frequent inspections of the odor scrubber system and additional monitoring at the fence line, were implemented in 2008.

Additional improvements are planned for South plant to help meet the odor reduction targets. These include covering and treating foul air from the mixed liquor channel, the remaining three passes of each aeration basin, and the primary sedimentation tanks. WTD is working closely with the City of Renton to implement these improvements. WTD expects to procure a design consultant in 2009 and begin design of these improvements in 2010.

6.2 Conveyance System Upgrades

RWSP policy calls for retrofitting conveyance facilities that pose nuisance odor problems with odor prevention systems as soon as such odors occur, subject to technical and financial feasibility. Table 6-1 lists projects to improve odor control in the conveyance system. The table includes the type of odor control technology planned and the anticipated completion date for each project. Two projects were completed in 2008: installation of carbon bed odor scrubbers and chemical injection systems at the Hidden Lake and Juanita Bay Pump Stations.

Table 6-1. Current and Planned Odor Control Projects in Existing Conveyance System

Facility	Odor Control Technology	Anticipated Completion Date
Hidden Lake Pump Station	Carbon bed odor scrubber & chemical injection	Completed in 2008 as part of the Hidden Lake Pump Station Replacement and Sewer Improvement project
Juanita Bay Pump Station	Carbon bed odor scrubber & chemical injection	Completed in 2008 as part of the Juanita Bay Pump Station Replacement project
Lake City Regulator Station	Replacement of phoenix/carbon scrubber with carbon bed odor scrubber	2nd quarter 2009
King Street Regulator Station	Carbon bed odor scrubber	3rd quarter 2009
Eastside Interceptor	Chemical injection	4th quarter 2009
53rd Avenue Pump Station	Carbon bed odor scrubber	4th quarter 2009
Sweyolocken Force Main Discharge	Replacement of phoenix/carbon scrubber with bioscrubber	4th quarter 2009
University Regulator Station	Carbon bed odor scrubber	4th quarter 2010
Bellevue Pump Station	Carbon bed odor scrubber & chemical injection	4th quarter 2011
Kirkland Pump Station	Carbon bed odor scrubber	1st quarter 2012
Kenmore Lakeline	Carbon bed odor scrubber & chemical injection	4th quarter 2013
Interbay Pump Station	Carbon bed odor scrubber	4th quarter 2013
Soos Creek Pump Station & Pipeline	Carbon bed odor scrubber & chemical injection	4th quarter 2020

6.3 Brightwater Odor Control System

RWSP policy directs the county to construct odor control systems for new regional treatment plants that meet the "best in the country for new facilities" level. Brightwater's odor control system was designed to meet this level and ensure there are no detectable odors at the property line for the Brightwater Treatment Plant. During the permitting for Brightwater, the county committed to meeting the "no odor at the fence line" requirement and also agreed to form an Air and Odor Advisory Panel to monitor the performance of the project in meeting that goal during startup and operation. RWSP policy also includes guidance on incorporating odor control systems into the design of associated new regional conveyance systems.

To remove odors from the Brightwater plant, air will be collected from treatment process units, enclosed buildings, and loading areas and then routed to odor control systems. All treatment process units will be covered, and buildings that house the headworks and solids handling equipment will be fully enclosed.[1] Odors from these facilities will be absorbed and neutralized

[1] The headworks is the first step in wastewater treatment. Large solids and grit are removed from the wastewater before it moves to the next step of treatment.

through a multistage treatment process that includes the use of biological, chemical, and carbon odor scrubbers. Concrete work on the odor facilities began in 2008 and is expected to be complete by the end of 2009. Equipment will be installed and tested in late 2009 and 2010 in preparation for startup in 2011.

Carbon scrubbers and bioscrubbers will be used to remove odors from the Brightwater conveyance system. Odor control facilities are being constructed at the Ballinger Way portal area, North Kenmore portal area, Influent Pump Station at the North Creek portal area, and the existing North Creek Pump Station.

Chapter 7

Biosolids Recycling and Energy Recovery

Biosolids are the nutrient-rich organic material produced by treating wastewater solids. After they are processed and treated, biosolids can be beneficially reused as a fertilizer and soil amendment. RWSP biosolids policies guide King County to continue to produce and market Class B biosolids and to evaluate alternative technologies to produce the highest quality marketable biosolids, including Class A biosolids.[1, 2] In addition, the policies call for the county to use methane, also produced during solids processing at the treatment plants, for energy and other purposes where cost-effective.

This chapter describes biosolids recycling and energy recovery accomplishments in 2008 in the following areas:

- Production and use of biosolids
- Biosolids research studies
- West Point Treatment Plant digestion improvements
- West Point Treatment Plant influent screening improvements
- Transition to International Organization for Standardization (ISO) 14001
- Request for Information on market options to supplement, strengthen, or diversify existing biosolids program
- A proviso in the 2009 King County Budget (adopted in November 2008) relating to the biosolids program
- Producing energy from methane that is generated during solids treatment
- Energy efficiency efforts.

More information on the Wastewater Treatment Division's (WTD) biosolids program is available at http://www.kingcounty.gov/environment/wastewater/Biosolids.aspx.

More information on WTD's energy recovery efforts is available at http://www.kingcounty.gov/environment/wastewater/EnergyRecovery.aspx

[1] Class B biosolids refer to biosolids that have been treated to significantly reduce pathogens to levels that are safe for beneficial use in land application.

[2] Class A biosolids refer to biosolids that have been treated to reduce pathogens to below detectable levels. Biosolids that meet this designation can be used without site access or crop harvest restrictions and are exempt from site-specific permits. Federal regulations require Class A level of quality for biosolids that are sold or given away in a bag or other container or that are applied to lawns or home gardens.

7.1 Production and Use of Biosolids in 2008

In 2008, WTD continued to produce high-quality Class B biosolids at the South and West Point Treatment Plants. Approximately 116,000 wet tons of biosolids were produced during the year, all of which was beneficially recycled and used as a fertilizer and soil amendment for forestry and agricultural applications and to make compost. The sale of biosolids generated $141,000 in fertilizer revenue from customers.

King County's biosolids were used as a fertilizer and soil amendment for a variety of applications:

- 5,220 acres of dryland wheat in Douglas County as part of the Boulder Park Soil Improvement Project
- 1,375 acres of hops and wheat at Natural Selection Farms located in the Yakima Valley
- 311 acres of state forestlands and 1,188 acres of Douglas-fir plantations in Hancock's Snoqualmie Forest as part of the Mountains to Sound Greenway Biosolids Forestry Program.

In addition, about 3 percent of King County's biosolids were used in GroCo compost. For more than 30 years, GroCo, Inc., has been producing and marketing this compost, which is a mixture of biosolids and sawdust, for use in residential and commercial landscaping, home gardens, and soil restoration.

Figure 7-1 shows the breakdown of how King County's biosolids were used in 2008.

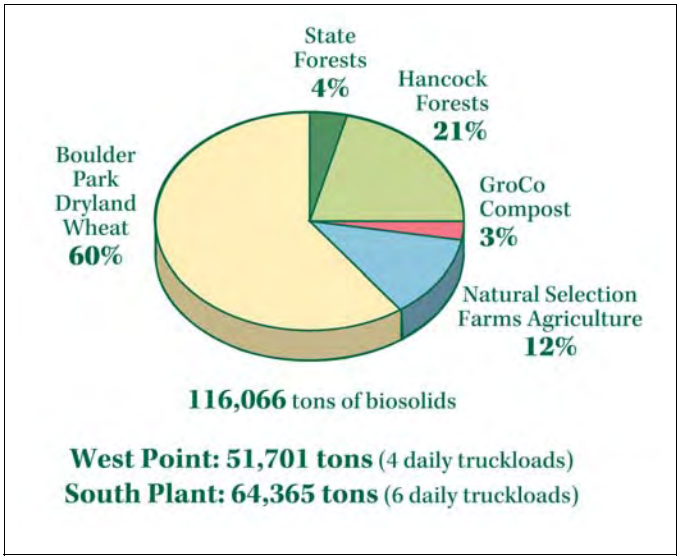


Figure 7-1. Breakdown of King County's Biosolids Uses in 2008

7.2 Research Studies

WTD participates in biosolids research studies through its membership in the Northwest Biosolids Management Association (NBMA). The NBMA is composed of more than 200 wastewater agencies and private companies that manage biosolids in Washington, Oregon, Idaho, Alaska, and British Columbia.

The NBMA has cooperative agreements regarding biosolids-related research with the University of Washington (UW), Washington State University (WSU), Oregon State University, and the University of Arizona's National Science Foundation Water Quality Center. Recent research efforts have focused on using biosolids as a tool to reduce greenhouse gas emissions by storing carbon in the soil. In 2008, a UW-WSU collaborative research project funded by the Washington State Department of Ecology was launched to quantify the carbon sequestration benefits of using biosolids and other organic residuals as a soil amendment for land application. Soils with and without biosolids are being sampled at existing field sites in Washington State, including long-term research plots and commercial farms, and the samples are being measured for carbon sequestration, water-holding capacity, and nutrient status. The researchers hypothesize that the use of biosolids as a soil amendment has the potential to reduce carbon footprint and at the same time help secure the sustainability of agriculture in the state. The study is expected to be complete in early 2009.

7.3 West Point Treatment Plant Digestion System Improvements

The West Point Treatment Plant Digestion System Improvements project will enhance the reliability of the plant's solids digestion system and reduce the risk of digester upsets under current and future solids loading conditions. The project includes installing tools such as monitors and sensors, modifying the blending storage tank (Digester 6) to enable its use as an emergency backup digester in the event of system instability or failure, improving the mixing system of Digesters 4 and 5, and upgrading the digester feed and transfer system. These improvements will increase operational efficiency and help further the production and recycling of high-quality biosolids into the future.

Project activities in 2008 focused on completing predesign. Final design is expected to begin in 2009 and be complete in 2010.

7.4 West Point Treatment Plant Influent Screening Improvements

Amendments to the state's biosolids management rule (Chapter 173-308 WAC) were made in June 2007. One of the amendments (WAC 173-308-205) requires "significant removal" of manufactured inerts from biosolids by July 1, 2012. Manufactured inerts are wastes such as

plastic, metals, ceramics, and other manufactured items that remain relatively unchanged during wastewater or solids treatment processes.

WTD is carrying out a project to design and construct the necessary modifications to the West Point plant's influent screening facilities to meet this new requirement. The project will replace the current bar screens that have five-eighths inch openings with bar screens that have three-eighths inch openings. A request for proposals for design and engineering services was issued in October 2008, and predesign work is expected to begin in summer 2009.

7.5 Transition to International Organization for Standardization 14001

In 2008, WTD began efforts to make a transition from its existing environmental management system (EMS) for biosolids to the International Organization for Standardization's EMS, known as ISO 14001. The ISO 14001 standard has international name recognition and broad public acceptance, is applicable to more of WTD's operations than other EMS certifications, and fits into the division's vision of "Creating Resources from Wastewater."

An EMS consists of a series of standard procedures and practices that organizations put in place to manage their environmental obligations. It provides a framework through which an organization looks at how its activities interact with the environment and how it can minimize any adverse impacts. Under an EMS, environmental stewardship becomes part of the daily responsibility across the entire organization.

Activities in 2008 focused on developing a manual that outlines how WTD will meet the requirements for ISO 14001 certification. The manual is scheduled to be finalized and published in February 2009. The next step in the transition process is to achieve ISO 14001 certification for the solids "fenceline."[3] This fenceline consists of source control/pre-treatment; removal and transport of grit and screenings; solids digestion, dewatering, and hauling; and land application of biosolids.

Anticipated near-term milestones in the ISO 14001 certification process are as follows:

- Compile necessary operating procedures and other documents related to the solids fenceline by June 2009
- Conduct internal solids audit in fall 2009
- Evaluate how the EMS is being implemented in the solids fenceline in winter 2009 and recommend other WTD fencelines for ISO certification
- Conduct the first official ISO certification audit for the solids fenceline in early 2010.

[3] "Fenceline" refers to a functional area of WTD operations and supporting activities identified by WTD for ISO certification.

7.6 Request for Information

In July 2008, WTD issued a request for information (RFI) to learn about market options available for supplementing, strengthening, or diversifying its existing biosolids program. Because the county is occasionally approached by vendors promoting other potential uses of biosolids, such as using biosolids as an alternative energy source or for land reclamation, WTD was interested in learning more about and comparing various options. It was especially interested in options that (1) avoid or manage the impacts of winter weather on biosolids transportation; (2) reduce the amount of diesel fuel used for transportation; or (3) use biosolids as a tool to reduce emissions of greenhouse gases. The goal of the RFI process is to provide the county with information on options for biosolids management in the next decade that are reliable, cost-effective, publicly acceptable, and provide multiple environmental benefits.

Twelve responses to the RFI were received in October 2008. The responses included information on using biosolids as an energy source, as a fertilizer and soil amendment, as material for compost, and as a tool to reclaim disturbed sites such as mines and gravel pits. Evaluation of the uses of biosolids provided in the responses is expected to be complete in early 2009. A summary of the findings will be included in the report that responds to the proviso in the 2009 King County Budget (described in the next section).

7.7 Budget Proviso

The 2009 King County Budget, which was approved by the King County Council in November 2008, includes a proviso directing WTD to transmit a report to the council for review and approval by motion. The report is to cover (1) the status of the work program for the biosolids program; (2) an analysis of alternative uses of biosolids being considered, but not limited to those proposed via a Request for Information in 2008, with the analysis including attributes, risk and reliability, flexibility, community support, cost and benefits; (3) recommendations for next steps; and (4) a schedule of potential implementation of biosolids alternatives utilization. The budget proviso calls for the report to be submitted by April 1, 2009.

7.8 Producing Energy from Methane

Digester gas is energy-rich methane gas naturally produced during solids treatment by microorganisms degrading solid organic matter. It can be used to generate heat, electricity, and natural gas. This section discusses energy recovery efforts in 2008 at WTD's regional treatment plants.

7.8.1 Energy Recovery at South Treatment Plant

At South plant, digester gas is used to fuel a boiler that provides heat for plant processes and buildings. The remainder of the gas is naturally "scrubbed" and sold to the local natural gas utility because this is the most cost-effective operating scenario right now. During months of

high energy use, a turbine cogeneration system consisting of two gas turbines and one steam turbine (Figure 7-2) may be used to generate supplemental heat and electricity and reduce peak load utility charges for the plant. The gas turbines run on scrubbed digester gas; the steam turbine runs on heat recovered from the gas turbines.

In 2008, about 0.23 million kilowatt hours of electricity were produced at South plant, which is enough to power 25 typical Seattle homes, and 2.1 million therms of natural gas was sold to Puget Sound Energy, which is enough to serve more than 2,500 homes.

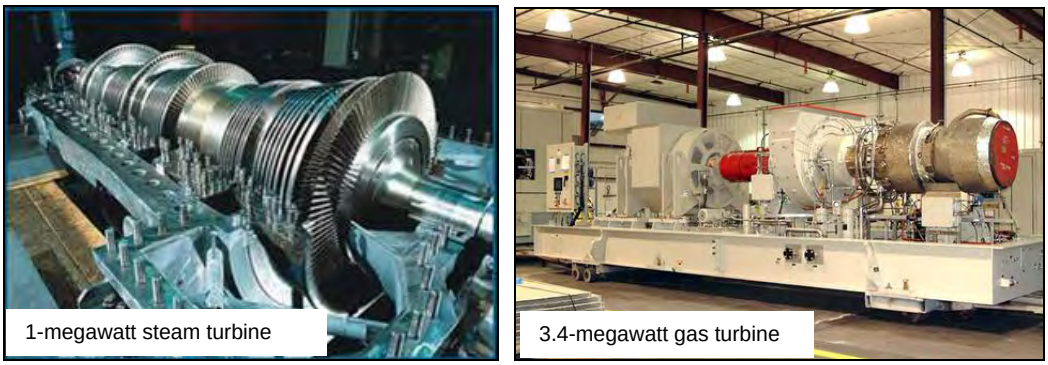


Figure 7-2. Turbine Cogeneration System

7.8.2 Energy Recovery at West Point Treatment Plant

At the West Point plant, digester gas is used to fuel (1) internal combustion engines that provide power to run the raw sewage pumps and (2) boilers that provide heat for plant processes and buildings. About 28 percent of the digester gas produced at West Point is used for these purposes.

WTD is carrying out a Waste-to-Energy project at the West Point plant to install a new cogeneration facility so that digester gas can again be used to generate electricity at the plant. The previous power cogeneration engines, installed in 1984, were removed from the plant site in 2008 after reaching the end of their useful life. The Waste-to-Energy project includes installation of two new internal combustion engines capable of supplying up to 4.6 megawatts of power. The engines are expected to begin producing power in 2012. Efforts in 2008 focused on work to secure a U.S. Environmental Protection Agency (EPA) grant to help fund the project. Work also included completion of National Environmental Policy Act requirements for establishing grant eligibility, which resulted in EPA issuance of a Finding of No Significant Impact for the project in May 2008. Final design efforts began in September 2008 and are expected to be complete in spring 2009. EPA grant appropriation will occur when design documents are 100 percent complete.

Efforts in 2008 also included work to ensure compliance with the National Historic Preservation Act (NHPA). Because the West Point plant site contains archaeological sites eligible for listing on the National Register of Historic Places, the NHPA requires development and execution of a memorandum of agreement (MOA). The MOA must describe how impacts to archaeological resources will be avoided and how any archaeological resources disturbed by the project will be

handled. WTD began working with the Muckleshoot Indian Tribe, the Suquamish Tribe, the Tulalip Tribes, EPA, the Washington Department of Archaeology and Historic Preservation, and the King County Historic Preservation Program to develop the MOA in 2008. The goal is to have the MOA negotiated and signed by these parties in 2009.

In 2008, efforts were also under way to negotiate a renewable power purchase agreement with Seattle City Light. The agreement will include information on the amount of electricity that WTD will have available for sale to City Light, the rate structure, and applicable renewable energy credits associated with project implementation.

7.8.3 Energy Recovery Efforts at Brightwater Treatment Plant

Some of the digester gas that will be produced at the Brightwater Treatment Plant will be used to fuel a boiler that generates heat for the digestion process and for buildings. In addition, plans are under way to develop an Energy Technology Demonstration Facility (ETDF) at the plant site for research of potential technologies for producing alternative forms of energy from digester gas. The goal of the ETDF is to provide a versatile platform for researchers and manufacturers in the Pacific Northwest to beta test a wide variety of nearly or commercially ready equipment using methane gas from the Brightwater plant for fuel.

Friends of the Hidden River, a community group of local teachers, continues to work with King County to develop broad support and secure funding for the ETDF. In 2007, grant funding was secured for civil and structural design, which was completed in 2008. In 2008, the county received $75,000 from the Washington State Legislature to complete the electrical design. Final design of the facility is expected to be complete in May 2009. Funding for construction is being sought from a mix of private and public sources.

7.9 WTD Energy Efficiency Efforts

The King County Energy Plan, drafted in 2007, contains two specific goals for WTD to reach by 2012: (1) achieve a 10 percent reduction in energy use, based on both the amount of water treated and the level to which it is treated, and (2) use renewable sources to satisfy 50 percent of WTD's energy demand.

Since 2007, WTD has been working on an energy plan to meet these goals and maintain a reliable energy supply. Treatment plant staff energy teams meet regularly to discuss ways to reduce energy usage at the plants. Energy audits are planned for WTD facilities that are high energy users (South and West Point plants and various pump stations). The goal of the audits is to identify opportunities to increase energy efficiencies at these facilities. In addition, the division is seeking funding to carry out other projects focused on energy efficiency and energy recovery. One recent example includes incentive funding from Puget Sound Energy to help defer initial capital investment costs associated with replacing two preaeration blowers at South plant with more efficient blowers.

Chapter 8

Reclaimed Water Program

Reclaimed water is wastewater treated to such a high level that it can be used safely and effectively for many purposes, such as irrigation, groundwater recharge, wetland enhancement, streamflow augmentation, street cleaning, and industrial cooling and process water. Production and use of reclaimed water can help King County to better manage its effluent and provide regional benefits such as reducing effluent discharges to Puget Sound and increasing flows for fish in local streams.

The RWSP calls for the county to actively pursue the use of reclaimed water to help preserve water supplies in the region, enhance or maintain fish runs, and preserve environmental and aesthetic values. RWSP policies encourage the county to work with local water purveyors to evaluate opportunities to use reclaimed water in their service areas and to explore ways to increase the use of reclaimed water at the county's existing and future wastewater treatment facilities. The policies also direct the county to evaluate reclaimed water as a potential alternative to meet identified conveyance needs.

This chapter describes reclaimed water accomplishments in 2008 in the following areas:

- Production and use of reclaimed water from the county's existing regional treatment plants—the South and West Point Treatment Plants
- Startup of the Carnation Treatment Plant
- Construction of the Brightwater reclaimed water system
- Initiation of a planning process to develop a Reclaimed Water Comprehensive Plan
- Reclaimed water studies
- A proviso in the 2009 King County Budget (adopted in November 2008) relating to the reclaimed water program.

The discussions for these topics also include plans for activities in 2009.

8.1 Reclaimed Water from Existing Regional Treatment Plants

King County's reclaimed water program has been active for more than 10 years. The Wastewater Treatment Division (WTD) has been producing reclaimed water since 1997 at the county's South Treatment Plant in Renton and West Point Treatment Plant in Seattle. All reclaimed water produced at WTD's existing facilities for off-site distribution—and those anticipated at future facilities—meets or will meet Class A reclaimed water standards, as defined by the Washington

State Departments of Ecology and Health. Reclaimed water standards vary from Class A to Class D, based on water quality parameters and allowable uses. Class A reclaimed water is the highest quality water and is allowed for all permitted uses of reclaimed water, which include non-potable uses such as irrigation, groundwater recharge, wetland enhancement, streamflow augmentation, and street cleaning.

South plant produced approximately 93 million gallons of Class A reclaimed water in 2008. The majority of the water was used at the plant for process water and irrigation, saving an estimated $80,000–$90,000 per year in potable water costs.[1] The remaining water was used off-site for the following purposes:

- Approximately 5–6 million gallons was sold to the City of Tukwila for irrigation of Fort Dent Park (including newly constructed soccer fields where the Seattle Sounders Football Club practices) and city public works uses such as street sweeping and sewer flushing.
- A small truck-and-haul program provided reclaimed water for irrigating newly planted vegetation on King County–managed stream restoration sites and a wetland/native plant nursery adjacent to the treatment plant operated by the King Conservation District (Figure 8-1).

In 2008, the county and the City of Tukwila renewed a sale and distribution agreement for reclaimed water, under which the city will continue to act as a reclaimed water purveyor in its service area. In addition, the Tukwila City Council approved an agreement in July 2008 to extend the reclaimed water distribution line from South plant to Foster Golf Links. Construction of a 500-foot pipe from the Interurban reclaimed water transmission line to Foster Golf Links began in early 2009. The City of Tukwila is managing construction of this pipe.

Figure 8-1. King Conservation District Nursery

[1] Net cost savings are avoided costs less reclaimed water system operating costs.

In 2008, the West Point Treatment Plant produced and used approximately 183 million gallons of Class A reclaimed water. All of the reclaimed water produced at West Point is exclusively used at the plant site for process water and irrigation in place of potable water, saving an estimated $450,000–$575,000 in potable water costs per year.[2]

8.2 Carnation Treatment Plant

The City of Carnation decided to replace on-site septic systems with a new wastewater treatment facility and collection system to better protect public health and the environment, achieve the city's comprehensive plan goals, and maintain and enhance community livability. The city designed and built the local wastewater collection system and contracted with King County to design, build, operate, and maintain a new treatment plant and associated discharge facilities.

Construction of the Carnation Treatment Plant (Figure 8-2) was completed in February 2008. The plant began operating in May, and a community celebration and dedication of the facility was held in June.

Figure 8-2. Carnation Treatment Plant

The Carnation plant uses membrane bioreactor technology (MBR) and is designed to treat all the wastewater to Class A reclaimed water standards. The plant has a dual discharge system: an outfall that discharges to the Snoqualmie River and another outfall that discharges to a wetland in the Chinook Bend Natural Area (Figure 8-3). The Reclaimed Water Use permit, authorizing discharge to the wetland, was approved in December 2008. Discharge to the wetland, which serves as the primary discharge location, is expected to begin in spring 2009. The river outfall is being used during plant startup. Once discharge begins to the wetland, the river outfall will be

[2] The West Point plant has a larger cost savings in potable water costs than South plant because West Point uses more than twice the water and pays a higher rate for the water. Net cost savings are avoided costs less reclaimed water system operating costs.

used only when required by a regulatory agency (such as when necessary to augment flows in the Snoqualmie River), in case of plant upset or failure of ultraviolet disinfection system, or during periods of scheduled maintenance. Since startup, the facility has consistently met Class A reclaimed water standards.

In August 2008, the Carnation Treatment Plant earned the WateReuse Association's Small Project of the Year Award in recognition of the facility's innovative use of reclaimed water to enhance wetlands and preserve local habitat at Chinook Bend Natural Area.[3]

More information on the Carnation Treatment Plant is available on the Web at http://www.kingcounty.gov/environment/wtd/About/System/Carnation.aspx.

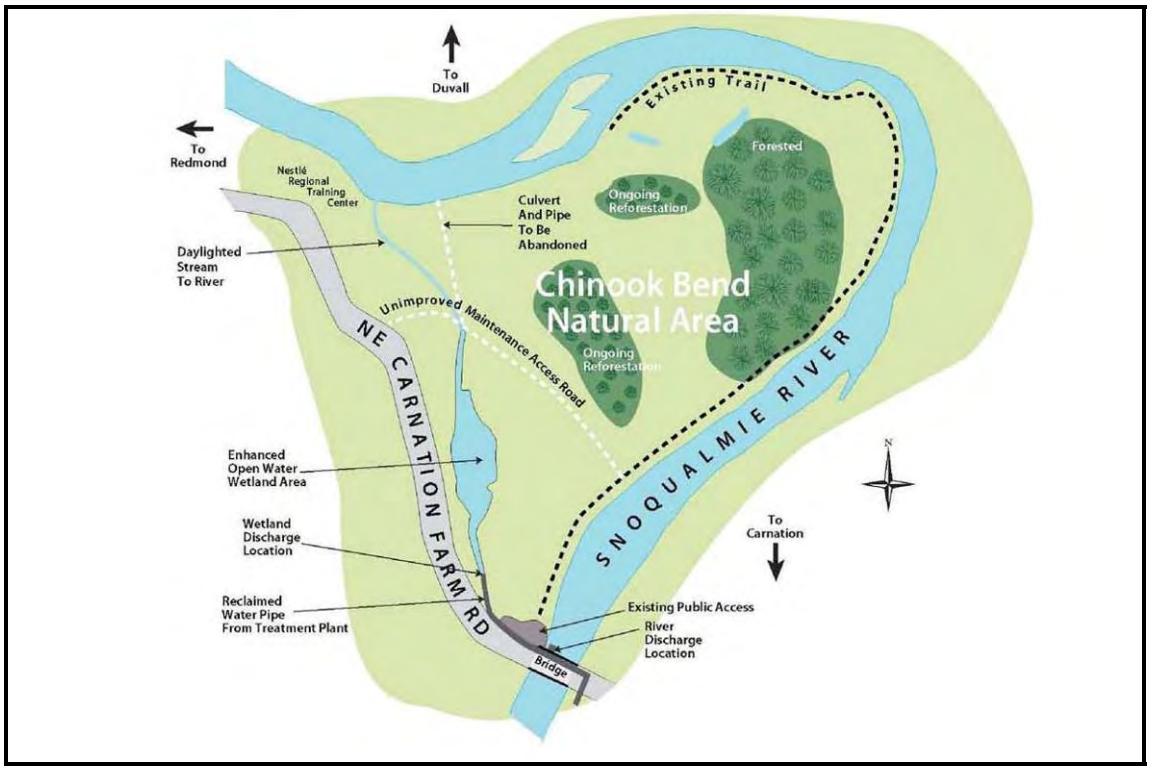


Figure 8-3. Chinook Bend Natural Area Wetland Enhancement

8.3 Brightwater Reclaimed Water System

The Brightwater reclaimed water system consists of south and west reclaimed water transmission lines that are commonly referred to as the Brightwater backbone (Figure 8-4). The backbone is under construction and will be completed as part of the larger Brightwater Treatment System project (see Chapter 2). The south transmission line, or South Segment, runs from the

[3] The WateReuse Association is a nonprofit organization whose mission is to advance the beneficial and efficient use of water resources through education, sound science, and technology using reclamation, recycling, reuse, and desalination for the benefit of its members, the public, and the environment. More information on the association is available on the Web at http://www.watereuse.org/.

Brightwater Treatment Plant through the Sammamish Valley. It will consist of two portions of new pipe and a portion of converted existing force main. The west transmission line, or West Segment, is a dedicated reclaimed water pipeline that is being installed inside the effluent tunnels that go from the Brightwater plant to the Ballinger Way Portal in the City of Shoreline. The West Segment is designed to allow distribution from the access portals along the effluent tunnel route.

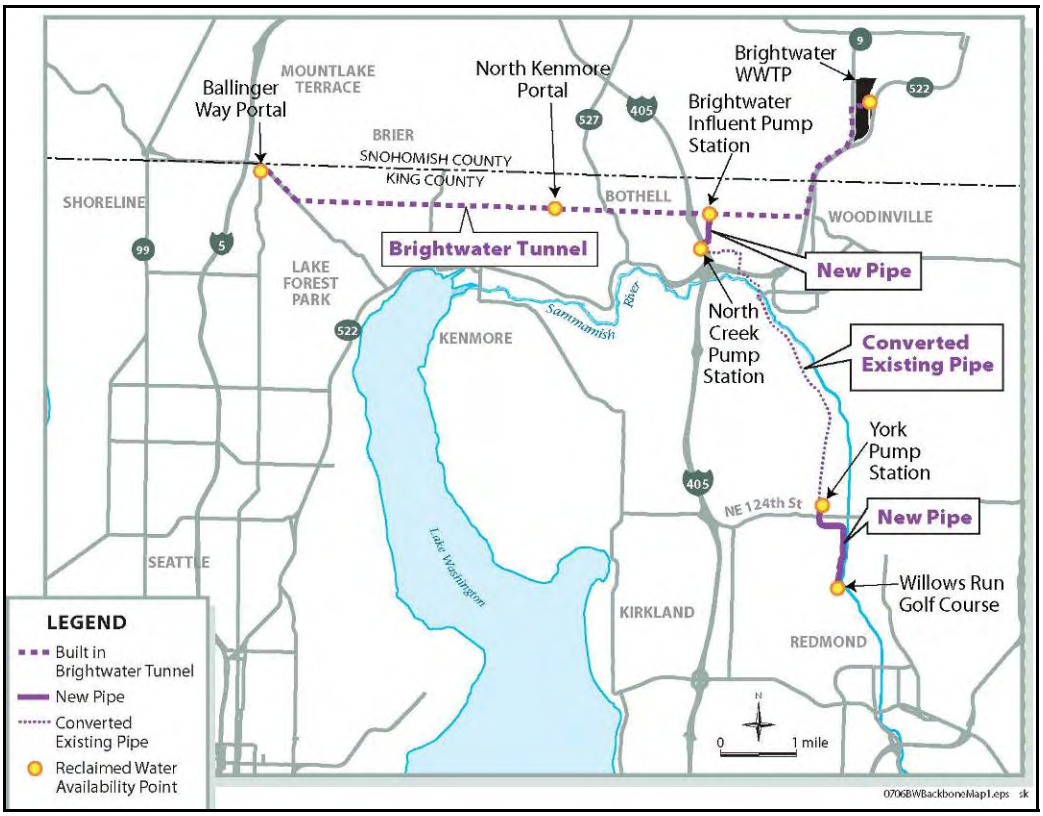


Figure 8-4. Brightwater Reclaimed Water System

Initially, only the South Segment will be operational. It will be able to start transporting up to 7 million gallons per day (mgd) of reclaimed water to the Sammamish Valley sometime in 2012. In 2008, construction was substantially complete on the portion of the South Segment that connects the Brightwater Influent Pump Station with the North Creek Pump Station. Construction was under way in 2008 on the remainder of the South Segment and is expected to be substantially complete in late 2009. WTD continued to work with local jurisdictions, water purveyors, and other interested entities to identify and confirm potential markets and demand for reclaimed water in the Sammamish Valley area. WTD also continued to work with water purveyors in this area to determine their interest in serving as reclaimed water purveyors in their service areas. These efforts will continue in 2009.

In October 2008, the King County Council approved Ordinance 16281, authorizing the King County Executive to execute a 30-year use agreement with the Lake Washington Youth Soccer Association (LWYSA) for development, operation, maintenance, and use of the county-owned Sixty Acres Park for a first-class soccer complex. As part of the agreement, LWYSA will pursue the use of reclaimed water for irrigation purposes at the soccer fields when it becomes available

from Brightwater. During 2008, WTD and the King County Parks and Recreation Division worked with LWYSA to develop engineering design alternatives and other technical information necessary to serve the park with reclaimed water from the South Segment of the Brightwater backbone. These efforts will continue in 2009.

Further infrastructure will be needed to enable use of the additional 14 mgd of reclaimed water that will be available from the Brightwater system. This infrastructure will be developed after demand for the water exists. Potential uses associated with these facilities will be evaluated in the Reclaimed Water Comprehensive Plan (described later in this chapter).

8.4 Reclaimed Water Comprehensive Plan

In July 2008, WTD began a planning process to develop a Reclaimed Water Comprehensive Plan (Plan) to determine if, how, when, where, and by what funding mechanisms over the next 30 years the county's existing reclaimed water program should expand. WTD is working with a broad range of interested parties and individuals in this multiyear planning effort, including tribal governments, local jurisdictions, water purveyors, wastewater utilities, regulatory agencies, environmental groups, business interests, and the public. WTD is also coordinating closely with the Metropolitan Water Pollution Abatement Advisory Committee on this effort.

Highlights of activities in 2008 are as follows:

- **Holding meetings to discuss the planning process and purpose of the Plan.** From July through mid-October 2008, WTD held meetings with 27 interested entities to get feedback on the planning process and contents of the Plan, identify potential uses for reclaimed water, and develop criteria to help evaluate potential uses for reclaimed water. A summary of these discussions is available on the Web at http://your.kingcounty.gov/dnrp/library/wastewater/rw/CompPlan/081030_Workshop01_MeetingSummaryJuly-Oct2008.pdf.
- **Convening a regional workshop.** A regional workshop was held in October 2008. Fifty people, representing tribes, state and regional agencies, cities, wastewater utilities, water purveyors, local and regional oversight organizations, and environmental groups, participated in the workshop. The purpose of the workshop was to share information about the planning process, summarize what had been heard to date in individual meetings, and discuss and solicit comments on evaluation criteria. A summary of the workshop is available on the Web at http://your.kingcounty.gov/dnrp/library/wastewater/rw/CompPlan/081205_Workshop01_Summary.pdf.
- **Collecting data on potential uses for reclaimed water.** In late 2008, WTD began meeting with local jurisdictions, water purveyors, wastewater utilities, and other interested parties to gather specific information on potential uses for reclaimed water and develop a database of identified potential reclaimed water consumptive and environmental enhancement uses for analysis during the planning process. These efforts will continue in 2009.

8.5 Reclaimed Water Studies

In 2008, WTD participated in four reclaimed water studies:

- Two studies—a turf irrigation study and an ornamental plant and food crop irrigation study—were undertaken in partnership with University of Washington researchers to develop local, independent, best-available science about the public health and environmental impacts of using reclaimed water.
- WTD is working with the Covington Water District to update the 2006 Covington Water District Water Reuse Feasibility Report.
- Seattle Public Utilities (SPU) started a reclaimed water feasibility study in summer 2008. SPU and WTD are working closely on this effort.

The following sections describe these studies.

8.5.1 Turf Grass Irrigation Study

The turf grass irrigation study was initiated in 2007 and completed in 2008. The study used turf grass collected from Foster Links Golf Course in Tukwila and irrigated it with Class A reclaimed water produced at South plant. It was conducted at the greenhouse at the University of Washington Botanic Gardens. The study focused on plant health and public safety issues associated with using reclaimed water from South plant to irrigate turf grass for local golf courses, business parks, and sports fields. Key research issues were salt buildup/tolerance, fate and transport of pharmaceuticals and chemicals found in personal care products, and grass growth response. The results indicate that irrigation of turf grass with reclaimed water from South plant fosters healthy growth without salt buildup, requires significantly less fertilizer (and therefore cost savings for golf courses), and carries no risk of exposure to pharmaceuticals and the chemicals under study.

The report, titled *Fate of Personal Care Products and Pharmaceuticals and Growth Response for Reclaimed Water Irrigated Turf Grass*, was published in 2008 and is available on the Web at http://www.kingcounty.gov/environment/wastewater/ReclaimedWater/ProgramLibrary.aspx.

8.5.2 Study of Ornamental Plant and Food Crop Irrigation

In 2008, WTD initiated a two-year study to look at plant growth response and human health effects associated with irrigating commercially grown ornamental plants and food crops with reclaimed water produced at South plant. The study was designed to address concerns expressed by potential reclaimed water customers, including commercial nurseries, local food producers, and flower farmers in the Sammamish Valley, regarding flower/leaf ratios, salt sensitivities, and aesthetic qualities. Local nursery and truck farmers assisted in the selection of ornamentals tested. Food crops that could be eaten raw (lettuce, strawberries, and carrots) were chosen because they pose a higher risk of exposure than from cooked vegetables.

Initial results from greenhouse trials conducted at South plant demonstrate that commercially marketable and aesthetically pleasing crops can be grown with reclaimed water from South plant. Washed and unwashed raw vegetables irrigated with reclaimed water were tested and met food safety standards for human consumption. The second year of research will be done under field conditions. The field site will be raised beds in South plant's demonstration garden (Figure 8-5). Beds of ornamentals and food crops will be grown with reclaimed water, potable water with fertilizer, and GroCo compost (produced from composted biosolids and sawdust). A final report is expected to be issued in early 2010.

Figure 8-5. Greenhouse at South Plant with Demonstration Garden Beds in the Distance

8.5.3 Covington Water Reuse Feasibility Study Update

King County and the Covington Water District signed a three-year Memorandum of Agreement in 2007 to jointly fund and pursue a phased approach to explore opportunities for reclaimed water development in the district's service area. In 2008, the two parties worked collaboratively on the first phase of an update to the 2006 Covington Water District Water Reuse Feasibility Report using current WTD flow data. Results from these efforts will be incorporated into the development of the Reclaimed Water Comprehensive Plan.

8.5.4 Seattle Public Utilities Reclaimed Water Feasibility Study

In summer 2008, SPU began a feasibility study of potential reclaimed water uses south of the Ballinger Way Portal on the west transmission line of the Brightwater reclaimed water system. The study area is generally north of the Lake Washington Ship Canal to the King County boundary. SPU will use the results of the study to help evaluate its level of interest in being a

reclaimed water purveyor in Seattle. WTD is working closely with SPU on the study and will incorporate the results into the Reclaimed Water Comprehensive Plan. The study is expected to be finished in 2009.

8.6 Budget Proviso

The 2009 King County Budget, which was approved by the King County Council in November 2008, includes a proviso directing WTD to transmit a report to the council for review and approval by motion. The report is to cover (1) the status of the work program related to reclaimed water and progress on the reclaimed water backbone project; (2) a status report on the division's efforts to market and establish contracts for the sale of reclaimed water produced at King County wastewater treatment facilities; and (3) analysis and development of preliminary rate structures and policies for the sale of reclaimed water from King County facilities. The budget proviso calls for the report to be submitted by June 1, 2009.

Chapter 9

RWSP Cost Estimates

RWSP reporting policies call for including in RWSP annual reports an update of the RWSP cost estimates through the year 2030. The cost estimates presented in this chapter include estimates for projects in various stages of development including planning, predesign, final design, and construction. Costs of completed RWSP projects are also included.

Details on RWSP capital projects in design and construction are provided as Appendix B. In accordance with RWSP reporting policies, the appendix presents a schedule, an expenditures summary (including staff labor and miscellaneous services), a description of any adjustments to costs and schedules, and the status of contracts for each project as of December 31, 2008.

This chapter presents the following:

- Discussion of the accuracy of cost estimates
- A table that compares 2008 and 2007 cost estimates
- Explanation of the entries in the cost comparison table
- Presentation of cost estimates organized by four categories: (1) completed RWSP projects; (2) Brightwater cost trend update; (3) RWSP projects in design or construction; and (4) projects planned for the future
- Information on the Wastewater Treatment Division's (WTD) Productivity Initiative Pilot Program.

9.1 Accuracy of Cost Estimates

The accuracy of cost estimates increases as projects become more defined and are specified in greater detail. Often the scopes of work and estimated costs for projects in the planning phase will change significantly as more detailed information becomes available over time.

Planning-level cost estimates are based on generic facility concepts. Specific details of a project such as location, technologies, and environmental impacts and potential mitigation of such impacts are determined later during project predesign. Costs for projects in planning can have a rough order-of-magnitude estimate in the range of -50 to +100 percent.[1, 2] By the time a project enters the construction phase, estimates typically narrow to a range of -10 to +15 percent of the final cost.

[1] Project Management Institute's *A Guide to the Project Management Body of Knowledge*, third edition, 2004.
[2] Order-of-magnitude estimates are estimates without detailed engineering data; they are often referred to as "ball park" estimates.

King County assumes a standard increase of 3 percent per year in projecting costs for its wastewater projects to account for price increases in project components such as materials, labor, equipment, supplies, and contractor markups. This rate is used because it closely approximates the actual rate of inflation over a long period of time.

9.2 Table Comparing 2008 and 2007 RWSP Cost Estimates

Table 9-1 summarizes the 2008 RWSP cost estimates and compares them to the 2007 cost estimates. The 2008 estimate for implementing the projects and programs associated with the RWSP through 2030 is approximately $3.35 billion in 2008 dollars, an increase of about $24 million, or 0.69 percent, from the 2007 RWSP cost estimate of $3.33 billion in 2008 dollars.

Total project cost estimates reflect anticipated costs from the initial planning stage through construction and startup. The estimates also include the costs for RWSP projects that have been completed and projects that are in the planning, design, or construction phase. Nearly one-fourth of the total 2008 RWSP cost estimate represents planning-level costs. As noted earlier in the chapter, planning-level cost estimates have a rough-order-of magnitude estimate in the range of -50 to +100 percent.

A complication to providing a meaningful comparison of costs is that the RWSP is an ongoing plan that includes expenditures incurred in the past plus expenditures planned for the future. In presenting the comparison shown in Table 9-1, expenditures that have occurred through 2008 are included at their original value and future expenditures, planned for 2009 to 2030, are adjusted for inflation to a base year of 2008.

An explanation of the columns and categories (including cost changes in each category) follows the table.

Table 9-1. Comparison of 2007 and 2008 RWSP Cost Estimates (1999–2030)

RWSP Element	2007 RWSP Cost Estimates (2007$ x 1M)	2007 RWSP Cost Estimates (2008$ x 1M)	2008 RWSP Cost Estimates (2008$ x 1M)	Cost Change (2008$ x 1M)
Total RWSP	**$3,264**	**$3,328**	**$3,351**	**$24**
Total Brightwater Treatment System[a]	**$1,732**	**$1,764**	**$1,764**	**--**
Brightwater Treatment Plant	$623	$638	$647	$9
Brightwater Conveyance	$861	$877	$867	($10)
Land and Right-of-Way	$102	$102	$103	$1
Mitigation	$145	$147	$147	--
Total Treatment & Odor Control Improvements	**$174**	**$177**	**$185**	**$8**
Odor Control at South Plant	$7	$7	$8	$1
West Point Odor Control	$2	$2	$1	--
West Point Digestion Improvements	$6	$6	$10	$4
King Street Regulator Odor Control Project	$5	$5	$6	$1
South Plant Expansion	$109	$113	$113	--
Vashon Treatment Plant Upgrade	$22	$22	$22	--
Carnation Treatment Plant	$20	$20	$22	$2
Chinook Wetlands Enhancement	$3	$3	$3	--
Total Conveyance System Improvements (CSI))	**$791**	**$804**	**$821**	**$17**
Completed CSI projects, acquisitions, and planning	$172	$172	$172	--
CSI projects in design or construction in 2008	$192	$193	$210	$17
Planned CSI projects, acquisitions, and planning	$426	$439	$439	--
Total Infiltration/Inflow (I/I) Reduction[b]	**$44**	**$44**	**$42**	**($2)**
Total Combined Sewer Overflow (CSO) Control	**$456**	**$469**	**$471**	**$1**
CSO Control Projects[c]	$400	$412	$412	--
CSO Planning and Updates	$8	$9	$10	$1
Sediment Management/Lower Duwamish Superfund	$47	$48	$48	--
Total Reclaimed Water	**$41**	**42**	**$42**	**--**
Technology Demonstration (completed in 2004)	$1	$1	$1	--
Future Water Reuse	$6	$6	$6	--
Water Reuse Satellite Facility (cancelled in 2003)	$5	$5	$5	--
Reclaimed Water Backbone	$25	$26	$26	--
RWSP Water/Wastewater Conservation (completed in 2005)	$1	$1	$1	--
Reclaimed Water Comprehensive Plan	$3	$3	$3	--
Water Quality Protection (completed in 2006)	**$16**	**$16**	**$16**	**--**
Habitat Conservation Plan (HCP)/ Programmatic Biological Assessment	**$8**	**$8**	**$8**	**--**
RWSP Planning and Reporting	**$2**	**$2**	**$2**	**--**

Notes: All costs in 2008 column are as of December 31, 2008; projects shown are not exhaustive, but are listed to illustrate changes. Totals may not add because of rounding to the nearest million. Expenditures that have occurred through 2008 are included at their original value.

[a] The Brightwater cost estimates are shown in constant dollars to be consistent with other components of total RWSP costs. Section 9.4.2 of this chapter discusses presenting Brightwater costs in nominal dollars, consistent with the Brightwater Cost Update: Current Conditions and Trends, January 2009.

[b] Design and construction costs for the initial I/I reduction projects are funded by the CSI program in accordance with the recommended program approved by the King County Council in 2006; therefore, costs associated with these projects are not shown in this line item.

[c] The 2007 and 2008 cost estimates for the CSO control projects are the 1998 planning-level estimates adjusted for inflation. Updated estimates for the CSO Puget Sound Beach projects are anticipated at the end of predesign. Planning-level cost estimates for the remainder of the CSO control projects are expected to be updated as part of the 2011 CSO Control program review.

9.3 Explanation of RWSP Cost-Estimate Comparison Table

Table 9-1 includes four columns:

- **2007 RWSP Cost Estimates (2007$ x 1M) column.** This column shows the 2007 RWSP cost estimates that were developed based on project details as of December 31, 2007, and that were presented in 2007 dollars in the RWSP 2007 Annual Report. The 2007 cost estimates include costs expended through 2007 at their original value and costs anticipated for 2008 through 2030 adjusted for 3 percent inflation to a base year of 2007.
- **2007 RWSP Cost Estimates (2008$ x 1M) column.** This column shows the 2007 RWSP cost estimates adjusted to 2008 dollars to create a common base for comparison with current estimates. Adjustments for inflation are based on the assumption of a standard increase of 3 percent per year. Expenditures that occurred through 2007 are included at their original value and not adjusted for inflation.
- **2008 RWSP Cost Estimates (2008$ x 1M) column.** This column shows the 2008 cost estimates in 2008 dollars that were developed based on project details as of December 31, 2008. Future expenditures—costs anticipated for 2009 through 2030—have been adjusted for 3 percent inflation to a base year of 2008. Expenditures that occurred through 2008 are included at their original value.
- **Cost Change (2008$ x 1M) column.** This column shows the changes in cost estimates from the 2007 cost estimates to the 2008 cost estimates in 2008 dollars.

The following sections provide more information on each category presented in Table 9-1.

9.3.1 Brightwater Treatment System

Brightwater costs planned for 2009 through 2012 have been adjusted to 2008 dollars to be consistent with the other RWSP costs. This is a different approach than the one used in the cost trend reports that are published annually.

The Brightwater 2008 cost estimate indicates a decrease in costs of 0.02 percent or $300,000 from the 2007 estimate. Because costs are rounded to the nearest million in Table 9-1, the table shows no change in the Brightwater costs from the 2007 estimate.

The Brightwater January 2009 cost trend update, which presents the Brightwater costs in nominal dollars (includes inflation), expresses the Brightwater cost trend in a range and indicates a decrease in costs of 0.13 percent ($2.3 million) to an increase in costs of 2.33 percent ($42 million) from the January 2008 cost trend update. The Brightwater cost trend update is discussed later in this chapter.

Chapter 2 provides more information on the Brightwater Treatment System.

9.3.2 Treatment and Odor Control Improvements

Costs for treatment and odor control improvements include treatment plant improvements and specific odor control improvements that result from implementing RWSP policies. The 2008 cost estimate for these projects is $185 million, an increase of about $8 million from the 2007 cost estimate. The following sections describe the projects and programs that make up the total cost estimate for this category.

- **Odor Control at South Plant.** The lifetime cost for this project increased by approximately $900,000. This increase is attributed to the additional structural work that was required to support the aeration basin covers.

  This project was complete as of summer 2008. No additional expenditures are expected for this project. The next phase of odor control will have a new project number.

- **West Point Odor Control.** The lifetime cost for this project decreased by approximately $200,000 because it was determined that a structural canopy intended to cover the sodium hypochlorite storage tank was not needed. Because costs are rounded to the nearest million in Table 9-1, the table shows no change in the cost change column for this project.

  Closeout activities for this project were completed in 2008. The 2008 cost estimate reflects the total expenditures for this project.

- **West Point Digestion Improvements.** The 2008 cost estimate for this project increased by approximately $4 million from the 2007 cost estimate. This change reflects updated construction cost estimates based on the final predesign report. Baseline costs will be developed during final design, which is expected to be complete in 2010.

- **King Street Regulator Odor Control Project.** The 2008 cost estimate for this project increased by approximately $700,000 from the 2007 cost estimate. This increase is attributed to necessary project changes, such as changing the structure to a buried facility, meeting requirements for a deep pile foundation design, disposing of contaminated on-site soils and groundwater, and adding an above-grade security enclosure to house electrical switch gear.

- **South Treatment Plant Expansion.** Because the South plant expansion is planned for 2029, the cost estimate for this project has not been updated since the 1998 RWSP cost estimate. The current estimate of $113 million reflects the 1998 preliminary planning-level estimate adjusted for inflation, using the 3 percent per year assumption, to 2008 dollars.

- **Vashon Treatment Plant Upgrade.** There were no cost changes from the 2007 cost estimate for this project. It was completed in spring 2007; closeout activities are expected to be complete in 2009.

- **Carnation Treatment Plant.** The lifetime cost for this project increased by approximately $2.5 million from the 2007 cost estimate. This change is attributed to (1) extending the project schedule to accommodate weather-related delays and equipment delivery delays and (2) the need for minor engineering and construction improvements,

which also resulted in the need for additional project management and project control services. The Carnation plant began operating in spring 2008; close-out activities are expected to occur in 2009.

- **Chinook Wetlands Enhancement.** There were no cost changes for this project from the 2007 cost estimate. This project is complete and no additional expenditures are expected.

9.3.3 Conveyance System Improvements

The 2008 cost estimate for RWSP conveyance system improvements is $821 million, an increase of approximately $17 million from the 2007 cost estimate. Over one-half of the total conveyance costs represent preliminary planning-level cost estimates.

There were no changes in costs associated with the completed projects or the planned projects categories.

The cost estimates for projects in design or construction increased by approximately $17 million. The majority of this increase is due to changes from the 2007 cost estimates for the following projects:

- **Black Diamond Infrastructure Upgrade**. The planning-level cost estimate for this project increased by approximately $7 million from the 2007 estimate. This change is a result of a more detailed project cost estimate that was developed based on the costs of wastewater storage facilities that were recently built in Western Washington.
- **North Creek Interceptor**. The cost estimate for this project increased by approximately $6 million. Design and construction costs increased to accommodate the requirements for additional micro-tunnel and dewatering locations. There have also been schedule delays and higher than anticipated costs in obtaining permits and easements. In addition, there were delays in awarding contracts because of a bid protest, which resulted in the need to re-bid the North Segment contract.
- **Bellevue Pump Station**. The cost estimate for the Bellevue Pump Station project increased by approximately $3 million. The lifetime budget for this project was updated to reflect the actual construction bid amount. The previous estimate was prepared prior to receiving construction bids and awarding the contract and notice to proceed.

Chapter 3 provides more information on RWSP conveyance system improvements.

9.3.4 Infiltration/Inflow

The regional infiltration/inflow (I/I) control program cost estimate was updated as part of the 2009-2015 budget preparation process. The total costs include expenditures of $40 million through 2007, which cover costs associated with the six-year I/I control study, including systemwide flow monitoring, construction of 10 pilot projects, and development of draft standards, procedures, policies, guidelines to reduce I/I in local systems, and overall program recommendations. The total costs also include $2 million in projected costs related to flow

monitoring for the initial I/I reduction projects; ongoing modeling, cost-benefit analysis, planning, and reporting; public education; and regional I/I clearinghouse and other program-related costs. These projected costs represent a decrease of $2 million from the 2007 estimate.

In accordance with the recommended I/I control program that was approved by the King County Council in May 2006, design and construction costs for the initial I/I reduction projects are funded by the Conveyance System Improvement Program and are not included as part of I/I program costs. The purpose of the recommended I/I control program is to invest in I/I reduction in lieu of investing in larger conveyance system improvements when it is cost-effective to do so.

Chapter 4 provides more information on the I/I Control Program.

9.3.5 Combined Sewer Overflow Control Program

The 2008 total Combined Sewer Overflow (CSO) Control Program cost estimate is $471 million, which is an increase of $1 million from the program's total cost estimate in 2007.

The CSO Control Program total cost estimate includes costs associated with CSO control projects, CSO planning and updates, the Sediment Management Program, and the Lower Duwamish Waterway Superfund projects.

- The cost estimates associated with CSO control projects represent the 1998 RWSP planning-level cost estimates of the 21 planned CSO control projects adjusted for inflation to 2008 dollars. Updated cost estimates for the CSO Puget Sound Beach projects (see chapter 5) will be available when predesign for these projects is completed. Planning-level costs for the remainder of the CSO control projects are expected to be updated as part of the 2011 CSO program review.

- The cost estimates associated with CSO planning and updates increased by approximately $1 million. This increase is due to additional staff needs associated with preparing the 2011 CSO program review and extending the timeline of the hydraulic model recalibration work.

- There were no cost changes from the 2007 cost estimate for the Sediment Management/Lower Duwamish Superfund category.

Chapter 5 provides more information on the CSO Control Program.

9.3.6 Reclaimed Water

There were no changes in the reclaimed water cost estimates from the 2007 cost estimates. The projects and programs that make up the total reclaimed water cost estimate are as follows:

- **Technology Demonstration Project.** This project was complete as of December 31, 2004. The costs shown in Table 9-1 reflect the total expenditures for this project.

- **Future Water Reuse.** The future water reuse category includes activities to support the existing reclaimed water program. There were no changes from the 2007 cost estimates in this category.
- **Sammamish Valley Reclaimed Water Facility (Water Reuse Satellite Facilities)**. This project was cancelled in favor of the reclaimed water capabilities at the Brightwater Treatment Plant. The amount shown in Table 9-1 reflects the total expenditures for this project prior to its cancellation.
- **Reclaimed Water Backbone.** There were no changes in costs from the 2007 cost estimate for this project.
- **RWSP Water/Wastewater Conservation Program.** This project was completed in 2005. The costs shown in Table 9-1 reflect the total expenditures for this project.
- **Reclaimed Water Comprehensive Plan.** There were no changes in costs from the 2007 cost estimate for this project.

Chapter 8 provides more information on the Reclaimed Water Program.

9.3.7 Water Quality Protection

This program provided scientific information on water quality and hydrologic conditions in both the Lake Washington and Green River watersheds and was complete as of December 2006. The amount shown in Table 9-1 reflects the total expenditures for this program.

9.3.8 Habitat Conservation Plan/Programmatic Biological Assessment

There were no changes from the 2007 cost estimate for this project.

9.3.9 RWSP Planning and Reporting

There were no changes from the 2007 cost estimate for this program.

9.4 Alternative Ways to Show RWSP Cost Estimates

This section presents RWSP costs in a manner to provide an informative snapshot of the progress being made and costs associated with implementing the RWSP. The RWSP costs are broken down by the following categories:

- **Completed RWSP Projects.** This category consists of projects for which all activity has been completed.

- **Brightwater Cost Trend Update.** This category consists of the trend estimate that is developed on an annual basis for the Brightwater project.
- **RWSP Projects in Design or Construction.** This category consists of all RWSP projects that are in the current capital improvement plan (CIP) budget for WTD.
- **Projects Planned for the Future.** This category consists of projects that have not yet begun.

Presenting costs this way provides a means to track incurred, current, and future costs separately as projects move through the categories. Because some categories present costs in nominal dollars and others in base-year or constant dollars, the sum of these categories will not yield a meaningful total cost comparison as is done with the estimates in Table 9-1.

An explanation and a summary table of each category follow.

9.4.1 Completed RWSP Projects

Completed RWSP projects refer to projects or programs that have been completed and for which no future expenditures are anticipated. Table 9-2 summarizes the expenditures associated with completed projects and compares expenditures as of December 31, 2008, to those as of December 31, 2007.

Table 9-2. Completed RWSP Projects (million dollars)

	Expenditures as of Dec. 31, 2007	Expenditures as of Dec. 31, 2008	Change from 2007
Total completed projects	**$236**	**$291**	**$55**
Total completed Conveyance System Improvement projects, acquisitions, planning	**$172**	**$172**	**--**
Total completed Treatment and Odor Control projects	**$1**	**$56**	**$55**
West Point Odor Control	$1	$1	--
South Plant Odor Control	--	$8	$8
Vashon Treatment Plant Upgrade	--	$22	$22
Carnation Treatment Plant	--	$22	$22
Chinook Wetlands Enhancement	--	$3	$3
Total completed Reclaimed Water projects	**$7**	**$7**	**--**
Technology Demonstration	$1	$1	--
Water Reuse Satellite Facility	$5	$5	--
RWSP/WW Conservation	$1	$1	--
Total completed I/I Pilot Study projects and program	**$40**	**$40**	**--**
Total completed Water Quality Protection	**$16**	**$16**	**--**

Note: Expenditures are shown at their original value. Totals may not add because of rounding to the nearest million.

The 2008 expenditures for completed projects are $55 million more than the expenditures as of December 31, 2007. This increase reflects completion of four projects in 2008: South Plant Odor

Control, Vashon Treatment Plant Upgrade, Carnation Treatment Plant, and Chinook Wetlands Enhancement.[3]

9.4.2 Brightwater Cost Trend Update

King County has prepared eight Brightwater cost estimates to date, beginning with the first conceptual estimate in 2001. The first estimate was a conceptual estimate developed in 2001 as part of the Brightwater siting analysis. The second and third estimates were released in 2002 and 2003 as part of the Draft and Final Environmental Impact Statements, respectively. These two estimates were based on the current Brightwater system configuration and included preliminary design information for the treatment plant and conveyance system. The fourth estimate was presented in October 2004 at the completion of 30 percent design. This estimate was subsequently adopted by the King County Council as the project's baseline budget. The fifth estimate, prepared in December 2005, reflected the completion of 60 percent design for the treatment plant and 100 percent design for much of the conveyance system. The sixth cost estimate, prepared in January 2007, described the project's transition from design to construction, a change that also necessitated a shift from constant (base year) dollars to nominal (inflated) dollars as a significant portion of the project's construction costs were established by contracts that included inflation. The seventh cost estimate, issued January 2008, reflected the project's near complete transition to construction, with over 98 percent of the construction contracts awarded, as well as actual costs incurred through 2007. It also included the costs for land and mitigation as part of the treatment and conveyance costs instead of being listed separately. The eighth estimate was prepared in January 2009 and is the subject of this section.

January 2009 Cost Estimate

Table 9-3 shows the current lifetime cost estimates for the Brightwater project expressed as a range. The low estimate reflects what is believed to be the most probable outcome based on current assumptions and known uncertainties. This estimate reflects WTD's assumption that King County will receive a tax exemption from the Washington State Department of Revenue related to the production and sale of reclaimed water and biosolids at the treatment plant. The high estimate in this range reflects the possibility that the county will not receive any exemption. Table 9-3 also shows that the high range of the January 2009 estimate falls within the range of lifetime costs estimated by R.W. Beck, the Brightwater project's independent Oversight Monitoring Consultant.

As of January 2009, the current lifetime cost estimate for the Brightwater project is $1.799 to $1.844 billion (including inflation).[4] This represents an overall decrease of $2.3 million, or about 0.13 percent to an increase of $42 million or about 2.3 percent as compared to the estimate presented in the January 2008 cost update (see Table 9-3).

[3] Although no additional expenditures are anticipated for these projects, close-out activities will occur through 2009 for some of these projects, and adjustments to the lifetime costs are possible.

[4] More details on the January 2009 Brightwater cost estimate are provided in Brightwater Cost Update: Current Conditions and Trends, Department of Natural Resources and Parks, Wastewater Treatment Division, January 2009. A copy of the report is available on request.

Table 9-3. Comparison of January 2008 and January 2009 Brightwater Cost Estimates (million dollars with inflation)

Brightwater Component	January 2008	January 2009		Dollar Change		Percent Change		November 2008 OMC Estimate	
		Low	High	Low	High	Low	High	Low	High
Treatment Plant	$875.3	$878.7	$889.6	$3.4	$14.3	0.39	1.64	$901 – $905	
Conveyance	$926.9	$921.2	$954.6	($5.7)	$27.7	-0.62	2.99	$ 942 – $945	
Total	**$1,802.2**	**$1,799.9**	**$1,844.3**	**($2.3)**	**$42.0**	**-0.13**	**2.33**	**$1,843–$1,849**	

OMC = Oversight Monitoring Consultant

9.4.3 RWSP Projects in Design or Construction

Table 9-4 shows the cost estimates of projects in design or construction as of December 31, 2008, and as of December 31, 2007. These projects were included as part of the 2009 and 2008 King County adopted budgets, respectively. The cost estimates are shown in inflated dollars. Some costs have been spent; some are allocated to out-years. For the 2007 estimate, the expenditures that occurred through 2007 are included at their original value; for the 2008 estimates, the expenditures through 2008 are included at their original value.

The cost estimates for projects in design or construction in 2008 is $348 million, a decrease of $22 million from the 2007 estimate of $370 million. This change is the net result of completion of the South Treatment Plant Odor Control, Vashon Treatment Plant Upgrade, Carnation Treatment Plant, and Carnation Wetland Enhancement projects, whose 2008 lifetime costs are included earlier in Table 9-2, and increases in costs of some of the projects in design and construction.

Table 9-4. RWSP Projects in Design or Construction (million dollars)

	2007 Cost Estimates[a]	2008 Cost Estimates[b]	Cost Change
Total Costs for RWSP Projects in Design/Construction	**$370**	**$348**	**($22)**
Total Conveyance Projects	**$197**	**$221**	**24**
Hidden Lake Pump Station/Boeing Trunk	$38	$38	--
Bellevue Pump Station	$32	$34	$3
Juanita Bay Pump Station	$37	$38	$1
Kent/Auburn Conveyance Improvements	$46	$51	$5
Black Diamond Storage	$5	$13	$8
North Creek Pipeline Project	$38	$45	$7
Northshore Utility District Acquisition	$1	$1	--
Total Treatment and Odor Control	**$63**	**$17**	**($46)**
Odor Control at South Plant[c]	$7	--	($7)
West Point Digestion Improvements	$6	$11	$5
King St Odor Control	$5	$6	$1
Vashon Treatment Plant[c]	$22	--	($22)
Carnation Treatment Plant[c]	$20	--	($20)
Chinook Wetland Enhancement[c]	$3	--	($3)
Total I/I[d]	**$4**	**$2**	**($2)**
Total CSO Control Program[e]	**$59**	**$61**	**$2**
Sediment Management/Lower Duwamish Superfund	$50	$51	$1
CSO Planning and Updates	$9	$10	$1
Habitat Conservation Plan (HCP)/Programmatic Biological Assessment	**$8**	**$8**	**--**
Reclaimed Water	**$36**	**$36**	**--**
Brightwater Reclaimed Water Backbone	$27	$27	--
Future Water Reuse	$6	$6	--
Reclaimed Water Comprehensive Plan	$3	$3	--
RWSP Planning and Reporting	**$3**	**$3**	**--**

Note: Totals may not add because of rounding to the nearest million.

[a] Project costs in this column reflect costs reported in the 2008–2013 WTD CIP budget submittal (October 2007).

[b] Project costs in this column reflect costs reported in the 2009–2014 WTD CIP budget submittal (October 2008).

[c] These projects were in design or construction in 2007, and completed during 2008. Their total expenditures for 2008 are reflected in Table 9-2, Completed RWSP Projects.

[d] These costs reflect projected costs related to flow monitoring for the initial I/I reduction projects; ongoing modeling, cost-benefit analysis, planning, and reporting; public education; and regional I/I clearinghouse and other program related costs. The expenditures associated with the I/I pilot programs are reflected in Table 9-2, Completed RWSP Projects.

[e] Although the Puget Sound Beach CSO control projects were included in the 2009–2014 WTD CIP budget submittal, they are not reflected in this table. Updated cost estimates for these projects will occur at the completion of predesign. Because their costs reflect planning-level costs, these project costs are included in Table 9-5, RWSP Projects Planned for the Future.

9.4.4 RWSP Projects Planned for the Future

Table 9-5 shows the planning-level cost estimates for projects planned in the future for 2007 and 2008. As was noted previously in the chapter, costs for projects in planning can have a rough order-of-magnitude estimate in the range of -50 to +100 percent. The costs in Table 9-5 are presented in constant (2008) dollars. Costs shown in constant dollars are adjusted for inflation (deflated) to reflect base-year prices and therefore do not include the effects of changing prices and inflation.

There were no cost changes in projects planned for the future from the 2007 estimates.

Table 9-5. RWSP Projects Planned for the Future

	2007 Cost Estimates (2007$ x 1M)	2007 Cost Estimate (2008$ x 1M)	2008 Cost Estimate (2008$ x 1M)	Cost Change (2007 x 1M)
Total Planned Projects	**$935**	**$964**	**$964**	**--**
Planned Conveyance Projects[a]	$426	$439	$439	--
Planned CSO Control Projects[b]	$400	$412	$412	--
Planned South Plant Expansion[c]	$109	$113	$113	--

[a] Conveyance project costs reflect the planning-level cost estimates that were developed as part of the 2007 Conveyance System Improvement Program Update and adjusted for inflation, using the 3 percent per year assumption, to 2008 dollars.
[b] CSO control project cost estimates for the planned CSO control projects reflect the 1998 planning-level estimates adjusted for inflation, using the 3 percent per year assumption, to 2008 dollars.
[c] South Plant expansion cost estimates reflect the 1998 planning-level estimate adjusted for inflation, using the 3 percent per year assumption, to 2008 dollars.

9.5 Productivity Initiative Pilot Program

RWSP Financial Policy-3 directs the King County Executive to maintain an ongoing program of reviewing business practices and potential cost-effective technologies and strategies for savings and efficiencies. To meet this policy guidance, the WTD Productivity Initiative Pilot Program was developed to identify and implement ways to increase efficiency. This 10-year incentive program applies certain private-sector business practices, including the establishment of an incentive-based cash payment to employees in the wastewater program, to reduce operating costs, increase productivity, and continue a high level of service and environmental protection for WTD's customers. The Productivity Initiative Pilot Program was approved by the King County Council for WTD's operating program in 2001.

The Productivity Initiative Pilot Program identifies specific levels of service, cost reductions and efficiencies over the period 2001–2010 that are anticipated to result in an estimated $75.9 million savings for ratepayers, while increasing levels of service to these same customers. Savings are achieved by undertaking an intensive review of current business practices, identifying and implementing cost-saving practices, working to increase employee involvement in business decisions, and ensuring that the wastewater program receives the best possible services from its partner agencies inside and outside the agency. Since the program was launched, it has expanded to include three pilot programs in the capital program: Major Capital Projects Pilot, Small In-House Capital Construction Projects Pilot, and Asset Management Pilot.

Positive productivity results were generated in 2008, the seventh year of the pilot program. The results marked the fifth time since 2001 that employees achieved an established productivity target for the operating program and earned a financial incentive for their work. Since 2001, a savings of $61.9 million for ratepayers has been achieved.

More information on WTD's Productivity Initiative is available at http://www.kingcounty.gov/environment/wtd/About/Finances/PI.aspx

Chapter 10

Water Quality Management and Compliance

The Wastewater Treatment Division (WTD) manages several programs to protect and preserve water quality. RWSP reporting policies call for RWSP annual reports to include a summary of WTD's water quality management programs and its compliance with the Endangered Species Act and with other agency regulations and agreements.

An important water quality protection task is to ensure that King County's wastewater treatment plants produce effluent that meets permit requirements and water quality standards. The quality of treated effluent from the treatment plants remained high in 2008. None of the four secondary plants—including the new Carnation plant—experienced National Pollutant Discharge Elimination System (NPDES) permit effluent limit exceptions during the year. Both the South plant and West Point plant earned the National Association of Clean Water Agencies (NACWA) Gold Peak Performance Award for achieving 100 percent compliance with their NPDES permits for an entire calendar year. These two plants also received the Platinum Peak Performance Award for multiple years of consecutive gold performance.

WTD is working to reduce marine discharges of treated effluent through expansion of its reclaimed water system (Chapter 8). In addition, it recycles 100 percent of the biosolids produced at the plants and recovers methane (digester gas) to generate energy for running plant operations and for sale to local utilities.

WTD has committed to controlling all its combined sewer overflow (CSO) locations by 2030 so that they meet the Washington State standard of an average of no more than one untreated discharge per year. Almost half of the county's CSOs are controlled thus far.

The best way to protect our waterways is to control pollutants at their sources. Two programs work to prevent pollutants from reaching King County treatment plants—the King County Industrial Waste Program and the Local Hazardous Waste Management Program. Among other achievements, these programs have helped to reduce the level of mercury in biosolids by 50 percent from measured levels in 2000.

This chapter reports on WTD water quality management and compliance activities in 2008. The 2008 results of the county's water quality monitoring program are included as Appendix C.

10.1 Wastewater Treatment Plant Capacity, Flows, and NPDES Compliance

On average, WTD's four secondary treatment plants processed over 161 million gallons of wastewater each day in 2008. All four plants operated without a single violation of their NPDES permit limits, although there were some violations of the CSO treatment plant limits in the West Point permit.

10.1.1 South Treatment Plant

The South Treatment Plant provides secondary treatment for wastewater flows from customers in the lower Green River basin, suburban cities east of Lake Washington, and Seattle's Rainier Valley, in addition to flows from parts of Snohomish and Pierce Counties. South plant also treats septic tank solids from the region and sludge from treatment facilities in neighboring areas such as Vashon Island and cities in the Snoqualmie Valley.

South plant is designed to manage an average dry-weather flow of 96 million gallons per day (mgd), average wet-weather flow of 115 mgd, and instantaneous maximum flow of 325 mgd.[1] Its dual outfalls at Duwamish Head in West Seattle discharge secondary effluent into Puget Sound 10,000 feet from shore at a depth of 600 feet into the denser deeper water layer.

Despite the fluctuation of influent volume and composition, South plant's secondary treatment process consistently produces high quality secondary effluent. In 2008, the plant accepted over 19.8 million gallons of septic tank solids, 33 percent more than in 2007. The increase in volume was mainly due to the temporary closure of a local company that also accepts septic tank solids. From November 2007 through April 2008, the plant managed an average wet-weather flow of 83.43 mgd and, in 2008, processed an average monthly volume of 70 mgd. Treatment efficiency remained high and consistent. During a high-intensity storm on December 3, 2007, primary treated effluent and secondary treated effluent were blended for 21 hours to maintain the optimum plant operation and to meet permit limits.

No NPDES permit effluent limit exceptions occurred during the year; the plant earned the NACWA Gold Peak Performance Award for 2008 and its Platinum Peak Performance Award for 10 consecutive years of gold performance.

An NPDES permit renewal application for South plant will be submitted to Washington State Department of Ecology (Ecology) early in 2009.

[1] For the South, Vashon, and Carnation plants, the average wet-weather flow (AWWF) is the average flow during the wet season, between November and April, on days when no rainfall has occurred on the previous day. For the West Point plant, the "non-storm" AWWF is calculated without counting the flow on days when it rains or the days immediately following a rain event.

10.1.2 West Point Treatment Plant

The West Point Treatment Plant provides secondary treatment for wastewater from customers located in the greater Seattle area and in southwest Snohomish County. West Point is the largest plant in the King County system. This plant is designed to manage an average dry-weather flow of 110 mgd, average non-storm wet-weather flow of 133 mgd, and instantaneous maximum flow of 440 mgd. After treatment, the secondary effluent is discharged through an outfall near the plant into Puget Sound. The outfall discharges 3,650 feet from shore at a depth of 240 feet.

West Point is designed to provide secondary treatment for up to 300 mgd of wastewater. Capacity between the 300-mgd capacity for secondary treatment (defined as 2.25 times the average wet-weather flow of 133 mgd) and the 440-mgd peak capacity is used to manage captured CSO flows. After receiving CSO treatment (equivalent to primary treatment), these flows are mixed with secondary effluent for disinfection, dechlorination, and discharge. The blended effluent must meet secondary effluent quality limits, with a small reduction in total suspended solids removal requirements (from 85 to 80 percent).

From November 2007 through April 2008, the average wet-weather flow through West Point was 130.77 mgd and, in 2008, the average monthly flow was 91.5 mgd. One disinfection failure occurred during the year. The failure had no effect on surface water quality, and its cause has since been corrected. No NPDES permit effluent limit exceptions occurred; however, the county paid a fine in 2008 because of a wastewater spill into Seattle's Ravenna Creek. The spill occurred after the county diverted wastewater into the Laurelhurst Trunk to facilitate repair of a flow sensor in the Lake City Tunnel. Unknown to the county, the diversion structure had an overflow weir that allowed flow to enter a storm sewer that leads to Ravenna Creek. During a significant rain event, the flow drained into the creek and then into University Slough. Major remediation of the creek was completed, and interim plugs were inserted in the system to prevent future flow of wastewater into the creek.

An NPDES permit renewal application for West Point was submitted to Ecology on June 30, 2008. The renewed permit was scheduled to be issued on December 31, 2008. The current permit was extended beyond December 31 to allow for a public hearing in January 2009 and subsequent comment period on provisions of the draft permit. Provisions of that draft permit include the following:[2]

- Disinfection system improvements at the plant
- Sediment monitoring at the plant outfall, and potential toxicity identification
- Increased scrutiny of CSOs, including more stringent fecal coliform limitations for CSO treatment plants, increased monitoring at the plant and CSO facilities, more frequent CSO data reporting, and gathering and synthesis of sediment data at CSO sites
- Additional study of pollutants from selected industrial areas
- Increased receiving water monitoring.

[2] These and other provisions of the draft NPDES permit are subject to revision based on Ecology review and public comment before issuance of the final permit.

West Point earned the NACWA Gold Peak Performance Award for 2008 and its Platinum Peak Performance Award for six consecutive years of gold performance.

10.1.3 Vashon Treatment Plant

The Vashon Treatment Plant is designed to manage an annual average flow of 0.18 mgd, maximum monthly average flow of 0.52 mgd, and instantaneous maximum flow of 2.05 mgd. An outfall discharges 2,900 feet offshore to Puget Sound at a depth of minus 200 feet mean lower low water.[3]

The 2007–2008 average wet-weather flow for the Vashon plant was 0.135 mgd, and the average monthly flow in 2008 was 0.124 mgd. The plant had no permit effluent limit exceptions during the year.

WTD also owns and operates the Beulah Park/Cove Treatment Facility on Vashon Island. This facility collects wastewater from approximately 60 residences via a vacuum system and pump station; treats the wastewater with a series of septic tanks, recirculating sand filters, and ultraviolet disinfection; and then pumps the effluent to a drip field for percolation to subsurface soils. King County reports quarterly on its operation. The facility did not consistently meet pH limits during five months in 2008. Operating procedures are being modified to address the pH problem.

10.1.4 Carnation Treatment Plant

The City of Carnation collects domestic wastewater from residential and commercial users and delivers it to the new King County–owned Carnation Treatment Plant. The plant began treating the city's wastewater on May 5, 2008.

The Carnation plant is designed to manage an average dry-weather flow of 0.21 mgd, average wet-weather flow of 0.22 mgd, and instantaneous maximum flow of 1.4 mgd. A key component of the treatment plant design is that all effluent is treated to Class A reclaimed water standards through a combination of membrane bioreactor technology and ultraviolet disinfection.[4]

The plant has a dual discharge system: (1) an outfall to the Snoqualmie River 2 feet above the riverbed near the western abutment of the Carnation Farm Road Bridge and (2) an outfall to the Chinook Bend wetland enhancement project off of NE Carnation Farm Road. The plant discharged effluent to the river in 2008 and will start discharging to the wetland in 2009. The river outfall will be used only when required by a regulatory agency for reasons such as augmenting in-river flows, when a plant upset occurs or the ultraviolet disinfection system fails, or when scheduled maintenance is being done.

[3] Mean lower low water is the average lower low tidal height over a 19-year period.

[4] "Class A Reclaimed Water" is reclaimed water that, at a minimum, is at all times an oxidized, coagulated, filtered, and disinfected wastewater. Beneficial uses of Class A reclaimed water include irrigation of food and non-food crops, irrigation of open access areas such as golf courses and parks, enhancement of natural resources such as wetlands, and industrial cooling and process water.

The average monthly flow volume from May through December 2008 was 0.087 mgd. The NPDES permit for the plant was issued on April 15, 2008, became effective on April 16, 2008, and expires April 15, 2013. The plant had no permit effluent limit exceptions in 2008.

10.2 Sanitary Sewer Overflows and Permit Deviations

Extensive resources have been committed to maintaining the integrity of the regional wastewater system and preventing sanitary sewer overflows (SSOs).[5] WTD's Maintenance and Asset Management groups regularly inspect, maintain, and repair facilities to prevent mechanical failures. In addition, WTD regularly updates its Conveyance System Improvement Program to ensure that conveyance facilities keep pace with projected needs for increased capacity.

Five SSOs and three permit deviations occurred in 2008 (Table 10-1 and Table 10-2), a significantly lower number compared to previous years. One type of permit deviation—interruption of disinfection—occurred at the West Point plant on one occasion during 2008, down from three in 2007. Because of short-term mechanical problems at both West Point and South plants, each plant experienced one occasion where a small volume of primary treated effluent was diverted around secondary treatment and then subsequently blended with the secondary effluent prior to discharge (also considered a permit deviation). The discharged blended effluent stayed within permit limits.

While there may be some short-term risk to public health and the environment from SSOs and permit deviations, the volumes of releases do not produce long-term effects. For all SSOs, WTD implements overflow response procedures, including posting the area, cleaning up the area as appropriate, and monitoring water quality in the vicinity of the overflow to determine when pollutant concentrations have returned to levels consistent with state Water Quality Standards.

[5] SSOs are discharges of wastewater from separated sewer systems and from combined systems when no rain is occurring. They can flow from manholes, broken pipes, or pump stations to city streets, water bodies, and basements.

Table 10-1. Sanitary Sewer Overflows in 2008

Date	Location	Estimated Volume (gallons)	Duration	Discharge Type	Receiving Water	Reason for Overflow
Mar. 4	North Creek Pump Station	10–18,000	15 minutes	Untreated wastewater	Potentially Sammamish River	A drain was inadvertently left open while the force main was being put into service.
May 29	Ravenna Drop Structure	800,000	Up to 10 days	Combined wastewater and stormwater	Ravenna Creek/University Slough	Lake City Tunnel flows were diverted to the Laurelhurst Trunk to facilitate repair of a flow sensor in the tunnel. An overflow weir and open gate allowed diverted flow to enter an unknown connection to a storm sewer. Major creek remediation was done, and plugs were inserted to prevent future flows to the creek.
Aug. 24	Ravenna Drop Structure	100,000	1 hour	Combined wastewater and stormwater	Ravenna Creek/University Slough	The plugs were removed temporarily to respond to a Washington State Department of Fish and Wildlife directive, which has since been rescinded.
Nov. 13	Beulah Park/ Cove Treatment Facility	5,700	2.5 hours	Untreated wastewater	On the ground near the facility	A treatment tank overfilled and spilled onto the ground. The area was cleaned.
Dec. 17	Juanita Bay Pump Station	~10	55 minutes	Untreated wastewater	Onto the street	A partially drained force main was accidentally punctured while a new pump station was being connected.

Table 10-2. Permit Deviations in 2008

Date	Location	Estimated Volume (gallons)	Duration	Discharge Type	Receiving Water	Reason for Permit Deviation
June 3	West Point Treatment Plant	Unknown	12 minutes	Treated wastewater; no disinfection	Puget Sound	Operator error caused a chlorinator to be unavailable. The error was quickly addressed.
Nov. 2	West Point Treatment Plant	310,000	21 minutes	Partially treated wastewater mixed with fully treated effluent	Puget Sound	An internal gate opened part way, causing primary treated effluent to bypass secondary treatment. Causes were corrected.
Nov. 7	South Treatment Plant	10,000	4–5 minutes	Partially treated wastewater mixed with fully treated effluent	Puget Sound	A gate automatically opened part way while the system was preparing to shift process modes. The problem was quickly corrected.

10.3 Combined Sewer Overflows

King County's CSO facilities are regulated through West Point's NPDES permit. With each permit renewal application (about every five years), WTD submits a CSO plan update to Ecology. WTD also submits a report to Ecology each year on annual CSO volumes and frequencies and on progress made to control its CSOs.[6]

Plans for controlling CSOs in King County began as early as 1979, after regional treatment plants and conveyance lines were in place. Almost 20 years of data demonstrate progress toward the control goal (Figure 10-1). As of May 2008, about 16 of King County's 38 CSOs are controlled. Two other CSOs—part of the Mercer/Elliott West CSO control system that came online in 2005—are expected to achieve control after startup adjustments and modifications are made to the system.[7] Control status will be confirmed in the hydraulic model recalibration that is scheduled to be ready in 2010. The remaining 20 uncontrolled CSOs will meet state standards as projects listed in the RWSP are completed between 2013 and 2030.

This section presents the volumes and frequencies of untreated and treated CSOs during the 2007–2008 wet season and the status of treatment facilities in meeting regulatory requirements during that time. See Chapter 5 for more information on the county's CSO control program.

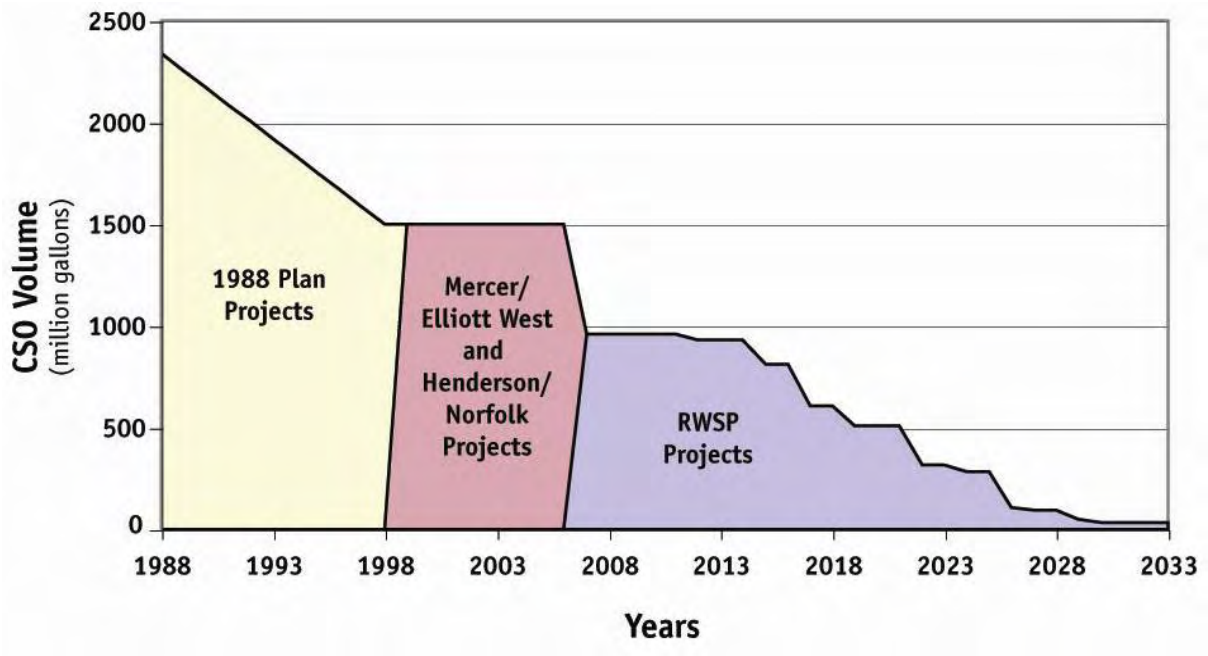


Figure 10-1. Actual and Planned CSO Reduction, 1988–2030

[6] "Control" is defined as meeting the Washington State standard of an average of no more than one untreated discharge per year per outfall.

[7] The two CSOs are the Denny Way and Dexter Avenue Regulator Stations.

10.3.1 Frequencies and Volumes of Untreated CSOs

King County assesses CSO data for the period from June 1 of one year through May 31 of the next year. The years 1981–1983 are used as the baseline for measuring progress toward controlling CSOs. Baseline volumes were determined using computer modeling. As shown in Figure 10-2, there is a pattern of decreasing volumes of untreated CSOs over time despite fluctuations in rainfall from year to year.[8]

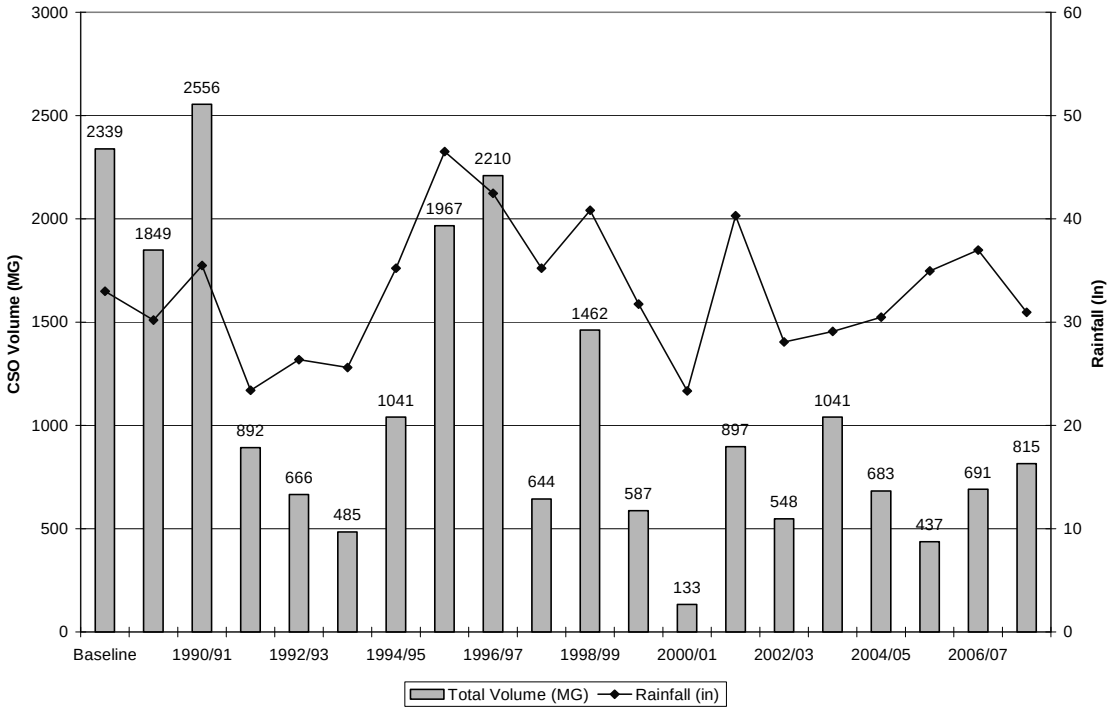


Figure 10-2. Annual CSO Volumes and Total Rainfall—1989 through 2008

In 2007–2008, a total of 87 untreated CSO events with a total discharge volume of 815.62 million gallons (MG) were recorded. These totals represent an 81.5 percent reduction in frequency over the 1981–1983 baseline of 471 events and a 65.2 percent reduction in volume over the 1981–1983 baseline of 2,339 MG.

While a reasonable relationship between annual rainfall and CSO volumes can be seen in Figure 10-2, large and/or intense storms can contribute most of the year's CSO volume, especially if the storms cause power outages and flooding at WTD facilities. This was the case in 2007–2008, when approximately 96 percent of the annual CSO volume was related to a storm that occurred December 3, 2007. The storm brought 3.77 inches of rain for the day at SeaTac Airport, the second highest total on record in the past 50 years. Average rainfall at gauges in the Seattle area was slightly higher at 4.10 inches, with some gauges recording as much as

[8] More information about volumes and frequencies for specific CSOs can be found in the Combined Sewer Overflow Program 2007–2008 Annual Report at http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/AnnualReport/2007-08_CSOAnnual.pdf.

4.50 inches in a 24-hour period. The amount and intensity of rainfall during this storm overwhelmed most of the system.

10.3.2 Frequencies and Volumes of Treated CSOs

In 2007–2008, treated flows were discharged a total of 22 times from King County's five CSO treatment facilities. Total discharge volume was 550.18 MG. Table 10-3 shows frequency and volume for each facility.

Table 10-3. Frequency and Volume of Treated CSOs June 2007–May 2008

CSO Facility	Events [a]	Volume (million gallons)
Alki plant	1	77.80
Carkeek plant	1	35.63
Elliott West	3	188.73
Henderson/Norfolk	1	19.80
West Point CSO process	16	228.22
TOTAL	**22**	**550.18**

[a] Events are defined by a 48-hour dry inter-event interval; West Point defines events in terms of days.

West Point Treatment Plant

For the 2007–2008 CSO year, there were 16 occurrences totaling 228.22 MG of treated CSO discharges from West Point.

Alki CSO Treatment Plant

The total volume of treated CSO discharged from the Alki CSO Treatment Plant was 77.80 MG; this discharge occurred during a single event in December 2007. Flows peaked over 60 mgd for most of the storm, which exceeded the capacity of the plant outfall under tidal conditions at the time. On the second day of the storm, the plant treated a record of 55 MG.

Modifications were made before the 2007–2008 season to address a flow surge that occurred in 2006–2007, to smooth out flow peaks, promote improved solids capture, and limit short circuiting of the bisulfite feed points. These problems were not experienced during the season. Further monitoring is required to gauge the success of these improvements, however, because only a single discharge occurred since they were made. The Alki plant met all its permit limits in

2007–2008 except for monthly and daily limits for chlorine residual. Improvements were made to the dechlorination system in late December 2007 to address this problem.

Carkeek CSO Treatment Plant

In the 2007–2008 wet season, the Carkeek CSO Treatment Plant operated nine times, with one discharge event totaling 35.63 MG. Pipers Creek flooded the plant during the December 2007 storm (Figure 10-3). The improved disinfection system and the new dechlorination system, both in their third year of operations, worked well in meeting the effluent fecal coliform and residual chlorine limits. All other permit limits were also met during the season.

Figure 10-3. Pipers Creek Overflowing into Carkeek CSO Plant on December 3, 2007.

Mercer/Elliott West CSO Control System

There were three discharge events in 2007–2008 from the Elliott West CSO outfall. The total discharge volume for the reporting period was 188.73 MG. During the first three years of operation, the Mercer/Elliott West CSO control system has presented several challenges. Such challenges are typical for large and complex CSO control systems. Moreover, the seasonal and intermittent operation of these facilities prolongs the commissioning period.

Hydraulic, solids management, and disinfection problems at the Elliott West CSO Treatment Facility are being identified and solutions are being implemented. In addition, the City of Seattle continues to investigate and try to remedy sources of sediments in its systems that are causing dry-weather flows to enter the Mercer Tunnel.

Elliott West CSO Treatment Facility

Despite improvements made to address these problems before the 2007–2008 season, an effluent overflow in Myrtle Edwards Park and a bacteria limit violation occurred as a result of the large December storm. Construction began in September 2008 to raise the elevation of the dechlorination and transition structures and to install new bisulfite mixing and sampling equipment to assist in meeting the chlorine discharge standards; modifications to the automatic sampling system were completed in 2008 to improve measurement of solids being captured and transported to West Point; and a contract is expected to be advertised in 2009 to improve performance of the chlorination and dechlorination systems. A final report containing recommendations for additional improvements to the facility is expected to be issued in November 2009.

Although the Mercer/Elliott West system has not yet achieved complete CSO control, it is making substantial progress toward meeting that goal. During the 2007–2008 wet season, the facilities met the total suspended solids percent removal limit for the first time. Substantial progress has also been made in controlling CSOs at the Denny and Dexter Regulator Stations. Untreated overflows at the Denny Regulator Station decreased to 1 from a baseline of 32 events, and volume decreased by 97.7 percent from pre-project levels. Programming changes made in August 2007 to the gate controls at the Dexter Regulator Station reduced the frequency of untreated overflows from an average of 15 to 5 events this year. While the volume of untreated CSO discharges was higher than the baseline, 99.7 percent occurred during the December 2007 storm. The second largest discharge was only 0.07 MG, suggesting that control may be achieved with additional refinement of the operating controls.

Henderson/Norfolk CSO Control System

In 2007–2008, 19.80 MG of treated CSO was discharged from the Henderson/Norfolk CSO Treatment Facilities to the Duwamish Waterway during one discharge event. This single discharge, which was in response to the December 2007 storm, occurred over 20 hours and was the largest discharge event to date from Henderson/Norfolk. No untreated discharges occurred at the three system outfalls (Henderson, Martin Luther King, and Norfolk).

The facility met all permit limits except the monthly and daily chlorine residual and fecal coliform limits. The hypochlorite feed rate required manual operation and chlorination was briefly lost during the December treatment event. Operations staff continues to troubleshoot and fine-tune the disinfection and dechlorination systems. Outcomes of their efforts will be evaluated during the coming season.

10.4 Pollution Source Control

Two source control programs in King County—the King County Industrial Waste Program and the Local Hazardous Waste Management Program—work to control pollutants at their source, thereby keeping them out of the wastewater system and, in turn, out of surface waters and the environment. The two programs complement each other. The King County Industrial Waste Program is operated by WTD. It focuses on larger businesses in a regulatory manner, issuing permits and discharge authorizations under a federally mandated pretreatment program. The

Local Hazardous Waste Management Program is a regional partnership under a state-mandated program that complements WTD's efforts to protect water quality. It focuses on smaller businesses and on households in a non-regulatory manner, providing technical assistance, resources, and education.

10.4.1 King County Industrial Waste Program

The King County Industrial Waste Program (KCIW) regulates industrial wastewater discharged into the King County wastewater system. The program serves to protect surface water and biosolids quality, the environment, public health, and the wastewater system and its workers. It does this by ensuring that industries treat wastewater for harmful substances such as metals, oils, acids, flammables, organic compounds, gases, and solids before discharging the wastewater to sewers.

The following sections describe KCIW's accomplishments in 2008. More information on the program can be found at http://www.kingcounty.gov/environment/wastewater/IndustrialWaste.aspx.

Permits, Authorizations, and Enforcement

KCIW may regulate any industry, from largest to smallest, if the industry discharges to the wastewater system. To do this, the program issues three main kinds of discharge approvals: letters of authorization, discharge authorizations, and permits. Letters of authorization are issued for limited-duration construction dewatering discharges. Discharge authorizations are issued to smaller industries. Permits are issued to industries that discharge more than 25,000 gallons per day and/or that are included in federally regulated categories. The U.S. Environmental Protection Agency (EPA) requires that at least 20 categories of industries obtain permits, whatever their size or quantity of wastewater. Permits have more comprehensive operating and self-monitoring requirements than do discharge authorizations.

Discharge of fats, oil, and grease from a petroleum or mineral origin (nonpolar FOG) is limited to 100 milligrams per liter. Industries must use oil/water separators to pretreat oily wastewater to prevent harm to the biological phase of wastewater treatment and must submit plans for the separators to the local sewer utility or to KCIW for review and approval before installing the separators. FOG from an animal or a vegetable origin (polar FOG) can block sewer lines. Although polar FOG has no numerical limit, dischargers are required to minimize free-floating polar FOG and may be required to complete a FOG control plan for King County's review and approval.

KCIW investigators inspect facilities before issuing discharge approvals and also inspect facilities with existing approvals to ensure that they are complying with regulations. Most companies are required to self-monitor their discharges. In addition, industrial waste specialists take verification samples at facilities that have been issued permits. If they find violations, the specialists conduct follow-up inspections and sampling.

The program issues a Notice of Violation when a company discharges more contaminants or volume than allowed, violates conditions of its discharge approval, or fails to submit required reports. For enforcement, KCIW uses tools such as compliance schedules, fines, charges for monitoring and inspections, and cost recovery for damages.

Table 10-4 shows the number of compliance samples collected versus the number of violations detected in 2008. During the year, 133 permits and 319 industrial waste discharge approvals were in effect and 435 inspections were conducted. A total of 112 Notices of Violation were issued to 29 companies (with several companies having multiple violations in more than one category):

- Seventeen companies had 35 discharge violations, including those based on self-monitoring data.
- Eleven companies had 48 permit/code violations.
- Nine companies had 29 reporting violations.

Three facilities had the most violations: Industrial Plating Corporation, a Seattle metal finishing company (11), the City of Redmond's decant facility (36), and TTM Technologies, Inc., a Redmond circuit board manufacturer (13).[9]

KCIW issued six fines totaling $163,912. The largest fine, $87,712, was issued to TTM Technologies, Inc. Sound Transit, the regional transit agency for central Puget Sound, was issued a fine of $44,750. In lieu of including in Sound Transit's fine an amount that equaled what it had gained financially by avoiding compliance ($54,872), KCIW agreed to allow the agency to perform a supplemental environmental project whose cost was equal in value to the amount of the fine that was avoided.

None of the violations identified by KCIW or by self-monitoring in 2008 caused NPDES permit exceptions at King County treatment plants.

[9] A decant facility is a place where vactor trucks that clean storm drains unload their water.

Table 10-4. Number and Type of Industrial Wastewater Compliance Samples Collected in 2008

	Compliance Monitoring	Post-Violation	Discharge Violation[d]
Cyanide amenable to chlorination	29		
Total cyanide	131		1
Metals	416	7	19
Organics			
BNA (base/neutral/acid)	34		4
VOA (volatile organic aromatic)	138		1
Fats, oils, and grease			
Polar[a]	20		1
Nonpolar	325		2
pH (field)[b]	527	17	6
Surcharge	490		
Miscellaneous[c]	98		2

[a] The polar fats, oils, and grease (FOG) analyses are for the visual free-floating FOG test, not laboratory analyses.

[b] The number of pH samples is somewhat misleading because it shows only discrete pH samples collected and analyzed in the field. The number does not include readings from continuous pH measurements.

[c] Miscellaneous includes tests for dissolved sulfide, hydrogen sulfide (H_2S) field, polychlorinated biphenyls (PCBs), settleable solids, total phosphorus, and turbidity.

[d] Discharge violations do not include those based on self-monitoring data.

Proposed Changes to King County Code and Public Rules

EPA's 2005 *Final Pretreatment Streamlining Rule* updated the National Pretreatment Program. The purpose of the rule is to reduce the burden of and provide flexibility in technical and administrative requirements for industrial users and publicly owned treatment works while continuing to protect the environment. For example, one provision has the potential to reduce KCIW monitoring from twice per year to once every other year or to once per year, depending on the industrial discharger. The reduced monitoring frequency could lower fees for some permit holders.

While parts of the rule were effective immediately, others require revisions to King County Code and public rules before they can be enacted. In 2008, KCIW proposed changes to both King County Code 28.84.060 and the public rules that govern the discharge of industrial waste into the wastewater treatment system. Two public hearings were held during the 45-day public comment period. The revised public rules (*Local Limits and Enforcement Response Plan*) became effective September 15. Final draft revisions to King County Code 28.84.060 will be presented to both Ecology and the King County Council in 2009. Additional opportunities for comment and review will be provided during the subsequent public comment process.

In light of the changes to code and public rule, KCIW proposed changes to the general requirements for the industrial pretreatment program during review of the draft NPDES permit

for the new Carnation Treatment Plant and the draft NPDES permit for the West Point Treatment Plant.

Mercury Reduction

KCIW's nationally prominent dental waste program allows dentists to demonstrate that they are in compliance with the local limits for mercury by installing a pretreatment unit commonly known as an amalgam separator.

KCIW tracks the amount of mercury in biosolids produced at the West Point and South plants as a means to generally gauge the effects of the dental waste program and other programs aimed at reducing mercury coming into the plants.[10] As shown in Figure 10-4, the amount of mercury in biosolids has dropped by over 50 percent from 2000, the year before King County began implementing the dental waste program, to 2004, the year in which a 97 percent compliance rate was achieved by local dentist offices. The 2008 median mercury concentration in biosolids from the West Point and South plants was 1.2 and 1.5 milligrams per kilogram (dry weight basis), respectively.[11] While West Point's concentrations have remained stable since 2004, South plant's concentrations reached a low point in 2006 and then rose in 2007 and 2008. Not enough data are available to determine if this is a trend.

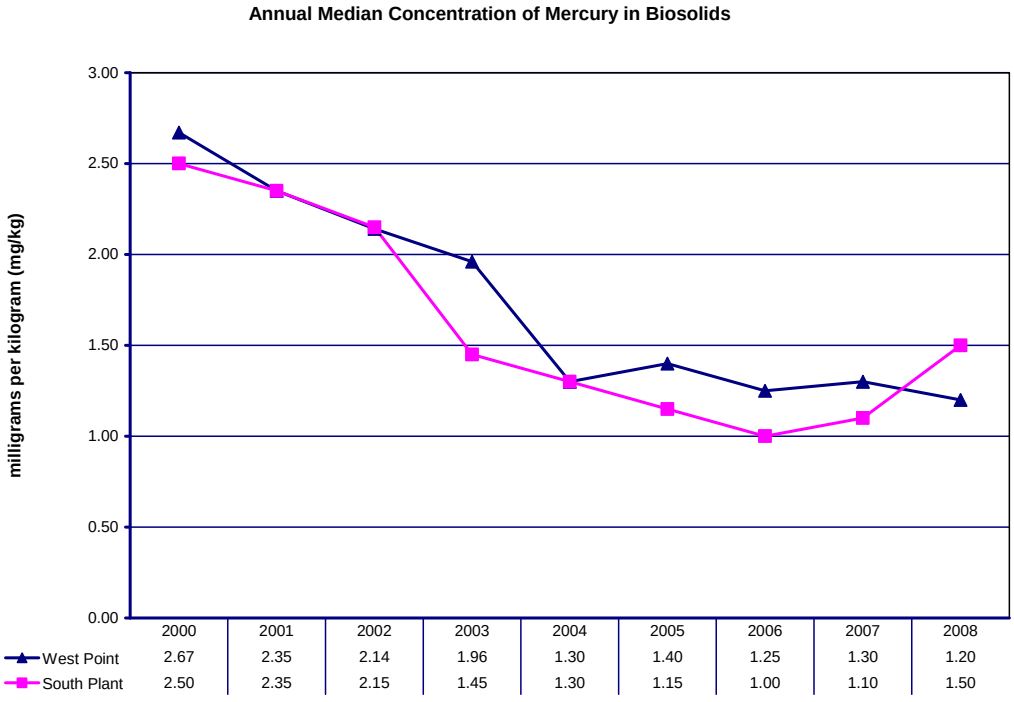


Figure 10-4. Decline of Mercury Concentrations in Biosolids, 2000 through 2008

[10] See also the discussion on the EnviroStars program in the section on the Local Hazardous Waste Management Program.

[11] Washington State's monthly average limit for mercury in biosolids is 17 milligrams per kilogram (WAC 173-308-160).

Other activities related to mercury reduction in 2008 include the following:

- Presented testimony before a subcommittee of the U.S. House of Representatives on King County's experience with both voluntary and regulatory programs to manage mercury discharges from dental offices.
- Participated in the Water Environment Research Foundation's project to estimate the potential for mercury bioaccumulation in waters that receive wastewater treatment plant effluent. KCIW provided samples and data from South plant.
- Conducted 97 random inspections of dental offices. All inspected offices were in compliance.
- Continued to be an active member of the Mercury Work Group under the NACWA.

Evaluation of Local Limits

Pretreatment programs are required to evaluate existing local discharge limits whenever there is a significant change in the wastewater treatment process or a significant change in influent quality at a wastewater treatment plant. New limits must be developed when the existing limits are determined to not be protective of an existing wastewater treatment system or when a new wastewater treatment plant is constructed. In 2008, KCIW evaluated whether the existing local discharge limits are protective of the new Carnation Treatment Plant's service area and planned for a similar evaluation of the future Brightwater Treatment Plant's service area.

Prior to startup of the Carnation plant in 2008, KCIW evaluated the proposed City of Carnation wastewater service area and conducted a survey of potential industrial users. The survey indicated that there are no industrial users in the Carnation service area that would require coverage under a discharge authorization or discharge permit. KCIW also evaluated the application of existing local discharge limits to discharges from hypothetical future industrial users in the service area. The evaluation determined that the existing local discharge limits would be protective as long as daily volume restrictions were imposed for specific parameters. If significant industrial users move into the Carnation service area, KCIW may need to reevaluate the efficacy of the limits.

Work in 2008 for the Brightwater plant involved fine-tuning flow-proportioning equipment and developing low-level metals sampling techniques. KCIW also developed a sampling and analysis plan for local limits sampling. In early 2009, the program will start collecting wastewater samples in the service area and, in 2010, will issue a local limits evaluation report.

Duwamish Waterway Source Control Projects

Although the sanitary wastewater component in CSOs is small and the industrial wastewater component even smaller still, KCIW actively seeks to control sewer-related pollution wherever it occurs in our system. To that end, the program is supporting efforts to clean up contaminated sediments in the Lower Duwamish Waterway (LDW) and East Waterway (EW) by participating in programs to control pollution at its sources and thus reduce the potential for recontamination

following cleanup. The efforts have helped hundreds of businesses and property owners meet regulatory obligations and correct issues such as hazardous waste storage, spill containment, and contaminant source removal.

Lower Duwamish Waterway

In 2008, KCIW performed the following source control activities in the Lower Duwamish drainage basin:

- **Sampling of industrial sewer dischargers for phthalates.** In 2006, KCIW collected 34 samples from industrial sewer dischargers in the LDW basin to analyze them for concentrations of two chemicals of concern—bis-2-ethylhexyl phthalate (BEHP) and butylbenzyl phthalate (BBzP)—and to determine if there are controllable industrial sources of these chemicals. Analysis indicated that the average industrial wastewater concentration of phthalates was at approximately the same concentration found in domestic/commercial areas of King County's wastewater system. A final report was issued in early 2008; findings were presented to the Industrial Waste Advisory Committee and an LDW stakeholder group.
- **Atmospheric deposition sampling.** From October 2005 to April 2007, KCIW staff collected 16 rounds of atmospheric deposition sampling in the LDW basin. The sampling was conducted to evaluate the atmospheric deposition pathway to the LDW for phthalates, carcinogenic polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). Analysis of the samples indicated that atmospheric deposition is a pathway that needs to be considered when evaluating sources of contamination to the LDW. The final monitoring report was completed in early 2008; findings were presented to the Industrial Waste Advisory Committee and an LDW stakeholder group.
- **Participation in the LDW Source Control Work Group.** KCIW participates in monthly meetings of the Lower Duwamish Waterway Source Control Work Group (SCWG). The group is composed of King County, Port of Seattle, and City of Seattle and the two agencies (Ecology and EPA) with regulatory responsibility for different aspects of LDW sediment remediation. SCWG was formed to discuss source control issues and activities that can affect sediment remediation in the LDW; it has met regularly for several years.

In addition to these activities, KCIW staff has reviewed drafts of various Ecology source control action plans and data gap reports, coordinated on source control issues in areas of the King County International Airport, and contributed to LDW communication and outreach efforts, including Ecology fact sheets, the Duwamish River Festival, a virtual Duwamish Waterway tour, and stakeholder meetings.

East Waterway

In 2008, KCIW began work on the Harbor Island Superfund site's East Waterway Operable Unit source control project. The project was initiated in 2007 in conjunction with sediment remediation, which is being implemented under an agreed order between the Port of Seattle and

EPA. The City of Seattle and King County are participating because of stormwater and CSO inputs to the EW.

Work in 2008 included planning and implementing source control activities, including business inspections and sampling, in order to supplement available chemistry data on CSOs. KCIW installed sediment traps and collected wet-weather wastewater samples from the Hanford No. 2 Regulator Station, collected solids samples during low flow from the Hanford No. 2 and Lander Street combined sewers, and collected wastewater samples for volatile organic compound analysis from the same sewers. In 2009, the effluent samples will be analyzed for PCBs, total organic carbon (TOC), semivolatile organic compounds (SVOCs), and metals. The solids samples are being analyzed for PCBs, total solids, TOC, SVOCs, and selected heavy metals. Results will indicate if additional source tracing is needed.

Also in 2008, KCIW collected samples of stormwater runoff to assess potential PCB concentrations in stormwater that enters the combined sewers from the south end of the old Rainier Brewery site that drains to the EW.

Urban Waters Initiative in Lower and East Duwamish Waterways

Ecology is implementing Urban Waters Initiative (UWI) source control inspections in the Lower Duwamish Waterway and East Waterway. UWI is being replicated simultaneously in two other urban basins in Washington State: Spokane and Commencement Bay. The City of Seattle and KCIW are participating in the initiative. During 2008, KCIW investigators conducted 16 inspections, which resulted in issuance of five discharge authorizations and three pending applications. KCIW also collected samples to follow up on source control issues observed during Ecology inspections. Some of the sampling data could be useful in interpreting CSO source characterization data. WTD is coordinating its sediment remediation activities in the Duwamish Waterway with the UWI work.

10.4.2 Local Hazardous Waste Management Program

The Local Hazardous Waste Management Program (LHWMP) brings together resources from four local government agencies and 37 suburban cities to protect and enhance public health and environmental quality by helping citizens, businesses, and government reduce the threat posed by the production, use, storage, and disposal of hazardous materials. The program is a regional partnership comprising King County Water and Land Resources Division and Solid Waste Division, Seattle Public Utilities, Public Health–Seattle & King County, and the Suburban Cities Association. In 2008, WTD paid about $2.4 million into the Local Hazardous Waste Fund to support LHWMP. The fees are based on the actual volume of wastewater treated at King County's treatment plants.

The program provides collection and recycling services for household hazardous materials and wastes and offers public outreach aimed at proper handling and reduction in use of hazardous products. It also provides technical assistance, incentives, and recognition to businesses that generate small quantities of hazardous waste. The following sections focus on services in 2008

that helped keep hazardous materials out of sewers in King County's wastewater service area and, thus, out of surface waters in the region.

Waste Disposal and Recycling

LHWMP furnishes King County residents with household hazardous waste collection services at the Household Hazardous Wastemobile, which travels throughout the county, and at three fixed facilities located in Factoria (Bellevue), North Seattle, and South Seattle. In 2008, the program collected 1,826 tons of household hazardous waste from more than 44,877 customers. Also in 2008, LHWMP began a pilot project to determine whether it should provide collection for businesses that generate infrequent, small volumes of hazardous waste. By the end of the year, 278 businesses had brought in 31.2 tons of waste. The pilot project has been extended through the end of 2009 and now is being offered at all LHWMP facilities. Were it not for LHWMP's collection services, much of this waste could have ended up in regional landfills, sewers, storm drains, and the environment.

In addition, LHWMP is participating in a statewide medicine take-back pilot project that began in 2006. So far, LHWMP and its partners, Group Health Cooperative and Bartell Drugs, have collected over 16,000 pounds of waste pharmaceuticals for safe destruction. In addition, LHWMP is promoting policies at the state and national level that require pharmaceutical manufacturers to offer services for the safe management of unused drugs so that the drugs do not fall into the wrong hands or end up in the sewers and in the environment. For more information see http://www.medicinereturn.com/.

Strategic Planning and Refocus

During 2008, LHWMP continued implementing its 2006 strategic plan. While continuing many of the program's existing activities, the plan places increasing emphasis on eliminating the inclusion of the most problematic chemicals in commercial or consumer products; reducing the use of hazardous materials in sensitive environmental areas such as groundwater and wellhead protection zones, flood hazard zones, and commercial generators on septic systems; and allocating more resources to reducing the exposure of the most vulnerable and historically underserved populations to toxic materials.[12]

The program is encouraging companies that manufacture hazardous products to reduce the toxicity of their products and to view their responsibilities for those products expansively, through their full lifecycle. Progress is being made with respect to establishing take-back systems for consumer electronics, which is now in state law; pharmaceuticals, with major initiatives under way; lighting products, with a national system recently announced; and paint. Local take-back efforts have been developed for thermostats, fluorescent lamps, and other problem wastes.[13]

[12] The most problematic chemicals include priority pesticides, bisphenol-A, solvents, mercury, pharmaceuticals, lead, and polybrominated diphenyl ethers (PBDEs).

[13] Take-back programs generally mean either that the manufacturers directly take back the product or that they pay for taking back and disposing of waste products, generally through a third party.

Community Outreach/Technical Assistance, Recognition, and Incentives for Businesses

LHWMP partners with community-based organizations, business organizations, trade organizations, housing authorities, and others to provide residents and businesses with information about ways to reduce the use of toxic and hazardous materials. Assistance and outreach programs and accomplishments in 2008 include the following:

- Recognizing businesses, through the EnviroStars program, for their efforts to reduce pollution. In 2008, 25 businesses in King County became new EnviroStars, bringing the total to 376, and 25 businesses increased their EnviroStars rating. Nine of the new EnviroStars were dental offices (some with more than one dentist) in recognition of their efforts to prevent discharge of mercury to sewers.
- Distributing at least 700 green home kits to historically underserved and vulnerable populations to promote proper disposal of household hazardous waste and the use of safer alternative products.
- Teaching students and educators about hazardous products and ways to reduce them, and working with schools to remove mercury and other hazardous materials.
- Providing technical consultations, fact sheets, brochures, and the Business Waste Line to help small businesses understand how to properly use, store, manage, and dispose of hazardous products and wastes. In 2008, the Business Waste Line assisted more than 1,626 callers, and field staff made at least 72 technical assistance visits to 70 businesses.
- Giving limited financial assistance to qualified businesses to facilitate waste disposal/reduction. In 2008, the Voucher Incentive Program reimbursed 68 businesses a total of approximately $25,700.

For additional information about LHWMP services, visit www.govlink.org/hazwaste/.

10.5 Endangered Species Act Compliance

WTD continues to consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service (“Services”), as required under Section 7 of the Endangered Species Act (ESA), on projects that require a federal permit or receive federal funding. WTD’s past efforts to develop programmatic agreements with the Services (habitat conservation plan, programmatic biological assessments) and its funding of a position at National Marine Fisheries Service (NMFS) to review projects have helped make the Section 7 consultations more predictable and efficient.

In 2008, WTD ESA compliance activities included completing a technical memorandum on the impact of reclaimed water on ESA-listed species. The memorandum is available as a resource for any future reclaimed water projects that require environmental review and ESA Section 7 consultations. WTD also continued funding a position at NMFS to review WTD projects.

Appendices

Appendix A. 2008 Summary of Odor Complaints

Appendix B. RWSP Project Reports

Appendix C. The Health of Our Waters, Water Quality Monitoring Results for 2008

Appendix A
2008 Summary of Odor Complaints

The Wastewater Treatment Division (WTD) received and investigated 46 odor complaints in 2008. Of these complaints, 36 were determined to be attributable to WTD wastewater facilities.

Detailed information for each complaint is included in the table below. The table lists the complaints in four groups:

- **West Point Treatment Plant Area.** This area is adjacent to the West Point plant. There were three complaints in 2008; all were attributed to WTD facilities.
- **West Service Offsite Area.** This area encompasses the pump stations, regulator stations, and pipes that deliver wastewater to the West Point plant. These facilities are generally located north and east of the plant. The area received 19 complaints in 2008; 16 were attributed to WTD facilities.
- **South Treatment Plant Area.** This area is adjacent to South plant. There were six complaints in 2008; four were attributed to WTD facilities.
- **South/East Service Offsite Area.** This area encompasses the pump stations, regulator stations, and pipes that deliver wastewater to South plant. These facilities are generally located south and east of the plant. The area received 18 complaints in 2008; 13 were attributed to WTD facilities.

Location	Date	Complaint	Investigation Findings/Resolution
West Point Treatment Plant Area			
West Point Treatment Plant	5/27/08	Complainant sensed strong odors while riding down the hill near the plant and at his residence during the early morning hours.	Upon investigation, odors were sensed at plant entrance. All odor control units were in operation. No further action was taken. Complaint was designated as King County.
West Point Treatment Plant	7/16/08	Complainant (same as 5/27/08) sensed strong sewage odors while riding his bicycle down the hill towards the West Point plant.	On investigation, odors were noticed around the digester area and the northwest preaeration tank. Cleaning of the preaeration tank was completed and the digester covers were hosed down on 7/17/08.
West Point Treatment Plant	8/6/08	Complainant (same as 5/27/08 & 7/16/08) sensed ammonia odors from the West Point plant while riding his bicycle down the hill to the entrance.	Odors were not detected during investigation; however, several crew members detected odors in that area 45 minutes earlier. A possible source of odor could have been when operators were filling the northwest preaeration tank in the late afternoon. No further action was taken at this time.

Location	Date	Complaint	Investigation Findings/Resolution
West Service Offsite Area			
Boeing Creek Park odor control unit	3/3/08	Complainant called the odor hotline to report strong odors near the Boeing Creek odor control stack that is designed as a tree snag.	During investigation, the drain valve for the odor control unit fan was found to be open. The drain valve was shut.
950 NW Carkeek Park Drive	3/7/08	Complainant sensed sewage odors near Piper Creek and observed greywater in the creek while hiking in Carkeek. Complaint was reported in a call from Seattle Public Utilities.	No odors or greywater were observed during the investigation. Complaint was designated as non-county.
10702 35th Avenue NE	3/12/08	Complainant sensed sewage odors but was not sure of the source.	The nearest facility is the Thornton Creek Siphon Inlet. During the investigation, slight sewage odors were detected coming from the hatches that lead to an aboveground vault. The hatches were resealed. The complainant was notified.
2530 Perkins Lane NE	5/23/08	Complaint was received from City of Lake Forest Park a few days after occurrence. Complainant contacted city about sensing strong rotten egg/methane odors on Perkins Lane. while walking her dog.	No odors were detected at the McAleer odor control unit during investigation. No further action was taken.
3637 Thorndyke Avenue	5/27/08	Complainant sensed strong odors near the Interbay Pump Station.	Upon investigation, it was found that parts of the ducting at the Wheeler Street odor control unit had disintegrated. The odor control unit at Wheeler Street was shut down on 5/30 for duct repair and the complainant was notified.
3213 Harbor Avenue	6/19/08	Initial complaint was received via e-mail from the Puget Sound Clean Air Agency (PSCAA). Complainant sensed sewage/methane odors inside his residence six times in the past month during the evening and early morning hours. The complainant lives next to the West Seattle Pump Station.	No odors were detected at the station at the time of investigation. During the investigation, the carbon was sampled and the condition of the carbon bed was good. An Odalog H_2S meter was installed at the exhaust vent to collect information from June 27 through July 24. Readings were 0 ppm (parts per million) for most of the time period; there were three days where there was a reading of 0.1 ppm (June 29, 30, and July 9.) The readings indicate these spikes lasted less than five minutes each.
Colman Park area (1800 Lake Washington Boulevard), Seattle	6/19/08	Complainant sensed strong rotten egg odors near Colman Park.	No odors were sensed at the nearest King County manhole at the time of investigation. Staff spoke with several groups of people who were out walking in the area and nobody had noticed any foul odors. No further action was taken at this time. The complaint was designated as non-county.

Location	Date	Complaint	Investigation Findings/Resolution
60 South Spokane Street	6/26/08	Complainant sensed moderate rotten egg odors inside and outside complaint area.	No odors were sensed at the West Seattle Force Main Drop Structure during the investigation; however, the Bioxide chemical feed system at the West Seattle Pump Station and the carbon in the structure's odor control unit were found to be spent at the same time and may have allowed odors to escape. The carbon was changed out and staff worked with the vendor to ensure this situation does not reoccur.
3225 East Marginal Way/Hanford Regulator Station	7/8/08	Worker complained of foul odors over the past week near the regulator station.	On investigation, no odors were detected. The air-handling unit in the station was checked; it was found that the exhaust fan airflow was too high and may have been the cause of the odors the complainant sensed. The variable pitch sheaves on the gate room exhaust fan were adjusted.
Manholes near Highway 202 and 175th Street, Woodinville	7/15/08	Complainant sensed very strong odors every day for the past three weeks from manhole covers near the Woodinville Pump Station.	A medium sewer gas odor was sensed at the time of investigation. The manholes were sealed and the South plant was contacted to verify chemical dosing at the Hollywood Pump Station. The Bioxide dosage was increased on 7/18/08.
Manholes near Highway 202 and 175th Street, Woodinville	7/16/08	Complainant (same as 7/15/08) complaint sensed strong odors; this time complainant was not sure where the odor was coming from.	The manhole covers were sealed on 7/15/08 and the Bioxide dosage was increased at the Hollywood Pump Station on 7/18/08.
Perkins Lane/ McAleer Odor Control Unit	8/2/08	Complainant sensed strong odors from the odor control unit on Perkins Lane in Lake Forest Park.	On investigation, odors were coming from the unit's exhaust. A work order was initiated to take a carbon sample from the unit to see if a change-out is needed. The pH of the carbon showed there was sufficient adsorption capacity. A worn boot was discovered on the ductwork and a temporary patch was installed. The worn boot was replaced with a new one.
19351 23rd Avenue NW - Manholes	9/10/08	Complainant sensed very strong rotten egg odors from manholes in the street in his neighborhood.	On investigation, it was discovered that Bioxide had run out at the Hidden Lake Pump Station. The chemical tank was refilled and the manholes near the complainant's home were sealed.
2303 NW 193rd Place	9/11/08	Initial complaint received via Ronald Wastewater District. Complainant sensed strong rotten egg odors from a manhole near the corner of her residence for several days.	Similar to the complaint on 9/10/08, Bioxide had run out at the Hidden Lake Pump Station. The chemical tank was refilled and the manholes were sealed near the complainant's home.

Location	Date	Complaint	Investigation Findings/Resolution
35th Avenue West and Government Way	9/17/08	Complainant sensed sewer odors each morning (starting 9/1/08) from a ravine behind her apartment building.	A slight sulfide odor was sensed upon investigation. A sewer main, which belongs to Seattle Public Utilities (SPU) is situated in the Kiwanis Ravine and the operator noticed one of the two PVC (polyvinyl chloride) lines tapping into the main was pulling apart with a 4-6 inches opening. The other PVC line was also showing signs of distress. The operator met with a SPU representative, who in turn issued a work order to repair the pipes. Designated as non-county complaint.
Manholes near Wilmot Park, Woodinville	9/26/08	Complainant sensed strong "nauseating methane" odors from manholes along the Sammamish River Trail near Wilmot Park and where the trail goes under the highway.	On investigation, no odors were sensed. The Hollywood Pump Station had been operating off and on a few weeks prior to the complaint (due to construction coordination) and the initial pumping may have contributed to odors coming out of the manholes downstream. The Hollywood Pump Station was checked to ensure that when the station is operating that the chemical pump is injecting Bioxide. The manholes near Wilmot Park and further downstream were caulked and sealed.
4039-B 7th Avenue NE (Lake City Tunnel Regulator)	11/2/08	Complainant sensed odors off and on for the past week.	On investigation, strong odors were sensed from the temporary mobile odor control unit discharge. The permanent odor control unit at the regulator station had been out of service for construction upgrades. A work order was generated and completed to add carbon to the mobile odor control unit.
19602 Richmond Beach Drive NE	11/5/08	Complainant sensed intermittent odors during the past 7-10 days and thought they may be coming from a manhole located on 196th and Richmond Beach Drive.	On investigation, moderate-to-strong sewage odors were sensed from nearby manholes, which were pressurized. The Bioxide system was off for the season at Hidden Lake Pump Station. Four manholes were sealed in the area. The complainant was notified of the findings.
142 NW Canal Street Fremont Siphon Forebay	12/1/08	Complainant sensed a strong sewage odor in his house, which is directly connected to the county main.	There have been past issues with pressurization in this line. The county will attempt to perform a smoke test to identify any leaks from the sewer into the house. Staff also suggested that the homeowner check his traps and roof vents.

Location	Date	Complaint	Investigation Findings/Resolution
South Treatment Plant Area			
South Treatment Plant (304 NW 2nd Street, Renton)	1/15/08	Complainant thought the odors may be coming from the Cedar Hills Landfill.	Complainant lives quite a distance away from the South Treatment Plant. Investigated area near residence and could not detect any sewage type odors, but did sense odors relating to "rotten" garbage. Staff informed complainant about the results of the investigation and suggested they contact PSCAA for further odor complaints. Designated as a non-county complaint
South Treatment Plant (13600 block of 53rd Avenue, Tukwila)	6/25/08	Odor complaint was recieved via e-mail from PSCAA. Complainant sensed rendering plant and ammonia-like odors on 6/19-6/20.	South plant is quite a distance from area of the complaint and was not the source of odors. Staff also checked the nearest King County facility, the Interurban Pump Station. No odors were detected around the pump station and H_2S levels coming out of the odor control unit exhaust was 15 parts per billion (ppb), which is considered low. Staff informed PSCAA of the findings. Complaint was designated as non-county.
South Treatment Plant (821 Powell Street)	7/17/08	Complainant sensed strong odors inside her building. There were no odors sensed outside of the building.	All odor control units at South plant were operating normally. There was a strong sludge odor emanating from secondary sedimentation tank 7 because of mechanical failure; it is possible the odors drifted into the complainant's heating, ventilation, and air conditioning system. The sheer pin for the sludge collector was replaced and the tank was drained and hosed to remove the odors.
South Treatment Plant	7/29/08	Complaint(s) were received via the City of Renton from the areas of Oaksdale Avenue (Extended Stay Hotel) and 555 Monster Road SW.	At the time of the investigation, all odor control units were in operation. The digester was opened for cleaning. Some rotted compost odor was sensed across the street from the plant a few days after the complaint was phoned in. Prechlorination of influent sewage was started. Plant and Assistant Plant Manager visited both businesses and informed personnel to call plant when odors are sensed.
South Treatment Plant	8/4/08	Complainant sensed very strong "rotten egg" odors at her place of employment (Extended Stay Hotel) located just east of the plant.	At the time of the complaint, a secondary tank that had been taken out of service had problems with a plugged drain valve and was not hosed in a timely manner. The tank was drained and hosed. The complainant was informed of the tank condition and corrective actions taken.

Location	Date	Complaint	Investigation Findings/Resolution
South Treatment Plant	8/15/08	Complainant sensed strong odors while driving near the treatment plant two weeks prior to contacting South plant.	No complaint response conducted due to the odor being sensed two weeks ago. The supervisor's log indicated no unusual plant activity occurring that day. The odor control unit checklists were checked and all units were operational and within pH and Oxidation Reduction Potential (ORP) parameter ranges. Prechlorination of influent sewage is continuing. No further action was taken at this time.
South/East Service Offsite Area			
Heathfield Pump Station	2/11/08	Complainant sensed odors coming from the roll up doors of the pump station.	No odors were detected around the pump station at the time of investigation. The odor control unit was operating properly.
York Discharge Structure	3/10/08	Complainant informed Facilities Maintenance about very strong rotten eggs/manure odors coming from the odor control unit.	No odors were detected at the time of investigation. Hydrogen Sulfide (H_2S) readings taken on 3/11/08 indicated that the carbon was not capturing the peak H_2S going into the unit. The carbon was changed on 3/19.
8622 Fauntleroy Way SW, Seattle	3/23/08	Complainant detected sewage odors one block north of ferry terminal and thought it might be coming from the Barton Pump Station.	The odor control unit was in operation at the time of investigation, and no odors were sensed. The station was also checked the next day and again no odors were present. Complaint was designated as non-county.
Hollywood Pump Station Force Main Discharge Structure	5/1/08	Complainant sensed odors by Sammamish River Trail next to the Hollywood Pump Station.	On investigation, it was discovered that odors were coming from the manhole at the force main discharge structure. The manhole was sealed.
North Mercer Pump Station	5/16/08	Complainant sensed rotten egg odor inside her residence, which is located west of the North Mercer Pump Station.	The Pepcon odor control unit was operating normally at the time of investigation and no odors were sensed around the pump station. No further action was taken at this time.
North Mercer Pump Station	5/19/08	Complainant sensed strong odors at same residence as 5/16/08 complaint.	At the time of complaint, the Pepcon odor control unit was out of service for salt recharging. The salt provides the chloride needed to oxidize the odorous sulfide gases. The unit was placed back in service and the complainant was informed.
South Mercer Pump Station	5/31/08	Complainant sensed strong odors in her yard, which is just north of the pump station.	On investigation, no odors were sensed at the odor control unit exhaust or in complainant's yard. Carbon samples taken from scrubber showed that the media still had a high pH and adsorption capacity remaining. Operator switched to backup carbon odor scrubber.

Location	Date	Complaint	Investigation Findings/Resolution
Fauntleroy Dock Ferry Booth/Barton Pump Station	6/22/08	Ferry personnel sensed strong sewage odors at the ticket booth.	Staff did not meet the two-hour response criterion. The odor control unit was checked two days after the complaint; no odors were sensed and low hydrogen sulfide was measured from the exhaust. The Purafil media in the odor control unit had been recently changed. No further action was taken.
Hayes Nursery/ Issaquah-Hobart Road in Issaquah	6/23/08	Complainant sensed widespread odors at her business and also three miles away at her residence. Complainant thought it might be coming from Cedar Grove Composting facility.	Staff gave complainant the phone number to PSCAA to file an odor complaint with the Agency. There are no King County facilities nearby the area of odors. The complaint was designated as non-county.
3407 164th Place SE, Bellevue	6/28/08	Complainant sensed very strong rotten egg odors for the past few days. Complainant thought odors are from the Heathfield Pump Station.	The odor control unit was operating at the time of investigation. No sewage odors were sensed around the pump station. The carbon in the odor control unit had been recently changed, (6/11/08). No further action was taken at this time. The complainant was informed of the results of the investigation. Complaint was designated as non-county.
SE 5th Street & 118th Avenue SE, Bellevue	7/3/08	Complainant sensed very strong sewage odors outside near her residence, which is near the Wilburton Siphon Inlet Structure.	An unsealed manhole cover that belongs to the city of Bellevue was noticed during the investigation. Slight odors were noticed when standing next to manhole. Staff informed the City of Bellevue. No further action was taken at this time.
8824 42nd Avenue South	7/29/08	Complainant sensed odors (multiple times per month) from the manhole hatch in her backyard located across the street from the Henderson/Norfolk Inlet Regulator Station.	There were whiffs of sewage sensed at the top of the hatch at the time of investigation (200-300 ppb H_2S). The odor control units at the regulator station were operating at the time of the complaint. The filters for the exhaust fan had some build-up of grease, which might have been preventing some of the foul air from being evacuated from the sewer into the odor control units. The fan filters were cleaned. The complainant was informed. If additional odors are sensed, the hatch will be caulked. No further complaints were received in 2008.

Location	Date	Complaint	Investigation Findings/Resolution
Lakeland Hills Pump Station	7/29/08	Complainant sensed odors that she thought were coming from the Lakeland Hills Pump Station.	There was a slight odor noticed from the wet well intake at the time of investigation. No action was taken at this time. South plant personnel attempted to inform the complainant of the findings by phone on two occasions. There was no answer and no machine to leave a message.
Issaquah Interceptor Manhole R17-38	8/5/08	Complainant informed South plant of odors emanating from a manhole that is part of the Issaquah Interceptor.	No odors were sensed at the time of investigation. The manhole was sealed with silicone.
Barton Street Pump Station	8/14/08	Supervisor of complainant phoned in to South plant about strong odors and said that an employee had to go visit a doctor and cannot come to work when it is hot and strong odors are present.	At the time of investigation, moderate sewage-like odors were sensed at the top of the pump station from all hatches (120 – 160 ppb H_2S). The filter preceding the odor control unit had a lot of grease buildup and was changed. Samples taken after the filter change found very low hydrogen sulfide levels (2 – 6 ppb), except from two smaller vents still being investigated. The filters are now changed out on a weekly basis. The complainant was forwarded the findings and results from the investigation.
Cranmar Creek Siphon Inlet Structure	8/18/08	Complainant sensed strong odors in his backyard, where the siphon inlet structure is located.	There is a passive carbon unit attached to the vent; the carbon in the unit was changed out the day after the complaint was received (8/19/08). The carbon change-out usually occurs on an annual basis, but from now on it will be changed out on a biannual basis.
3456 61st Avenue, West Seattle	10/23/08	Complaint was received from SPU, nine hours after citizen informed SPU.	At the time of the investigation, no odors were present. The fan for the 63rd Avenue pump station at Alki was operating. Further investigation of the area pinpointed the odor emanating from a vent that could be a storm drain. There was no label designating it as King County or the City of Seattle. Geographic Information System (GIS) prints were obtained to identify the responsible party for maintaining the vent. The prints showed that the manhole belongs to Seattle. WTD staff shared the prints with SPU staff. The complaint was designated as non-county.

Location	Date	Complaint	Investigation Findings/Resolution
Wilburton Siphon Inlet Structure	12/10/08	Complainant sensed intermittent odors (mainly during the night) near her house, which is close to the Wilburton Siphon Inlet Structure.	On investigation, it was found that the structure was not firmly sealed and the mobile odor control unit that was evacuating foul air from the structure was shut off. The lid of the structure was recaulked and the fan to the mobile odor control unit was restarted.

Appendix B

RWSP Project Reports

The RWSP reporting policies call for annual reports to provide details on RWSP capital projects, including a project schedule, an expenditures summary (including staff labor and miscellaneous services), a description of adjustments to costs and schedules, and a status of the project contracts. This appendix meets these requirements and includes a project report for the following RWSP capital projects that were in design or construction during 2008:

- Brightwater Treatment Plant, project #423484[1]
- Brightwater Conveyance, project #423575
- Brightwater Reclaimed Water Pipeline, project #423600
- Carnation Treatment Plant, project #423557
- Chinook Wetlands Enhancement, project #423611
- West Point Odor Control Improvements, project #423584
- South Plant Odor Control Improvements, project #423585
- King Street Regulator Odor Control, project #423580
- Bellevue Pump Station, project #423521
- Black Diamond Storage Facility, project #423615
- SW Interceptor (Kent/Auburn Conveyance System Improvements), project #423582
- Hidden Lake Pump Station and Boeing Creek Trunk, project #423365
- Juanita Bay Pump Station, project #423406
- North Creek Pipeline, project #423596
- RWSP Local System Infiltration/Inflow (I/I) Control, project #423297
- RWSP Local Systems I/I Implementation (I/I Initial Projects), project #423618

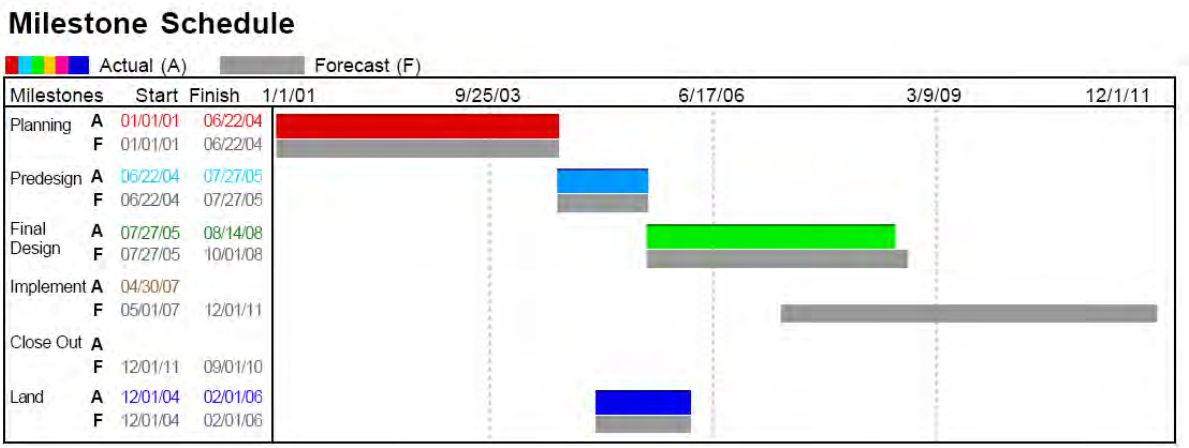
[1]Each wastewater capital project is assigned a six-digit number such as 423484. The first two numbers (42) identify this as a wastewater project (as opposed to a transit or roads project). The third number (3) identifies the project as capital project (as opposed to operating) and the last three numbers are sequential numbers reflecting the order the projects were assigned in a particular year.

- West Point Digestion Improvements, project #423593
- Magnolia Combined Sewer Overflow (CSO) Control and Improvements, project #423607
- Murray CSO Control and Improvements, project #423608
- North Beach CSO Control and Improvements, project #423609
- Barton CSO Control and Improvements, project #423610
- Sediment Management Program, project #423368
- Lower Duwamish Waterway Superfund, project #423589

Each report is generated from the Wastewater Treatment Division (WTD) Project Management and Financial Forecast Database. An explanation of the information provided in each report follows.

Schedule and Cost Summary Page

The second page of each report shows the project's milestone schedule in a bar graph format. The graph includes timelines for the various phases of a project: planning, predesign, final design, implementation, close out, and land acquisition. An example of a project schedule is provided below.



Schedule Adjustments

An explanation of significant schedule adjustments, if any, is provided in this area; if there are none, this area is left blank.

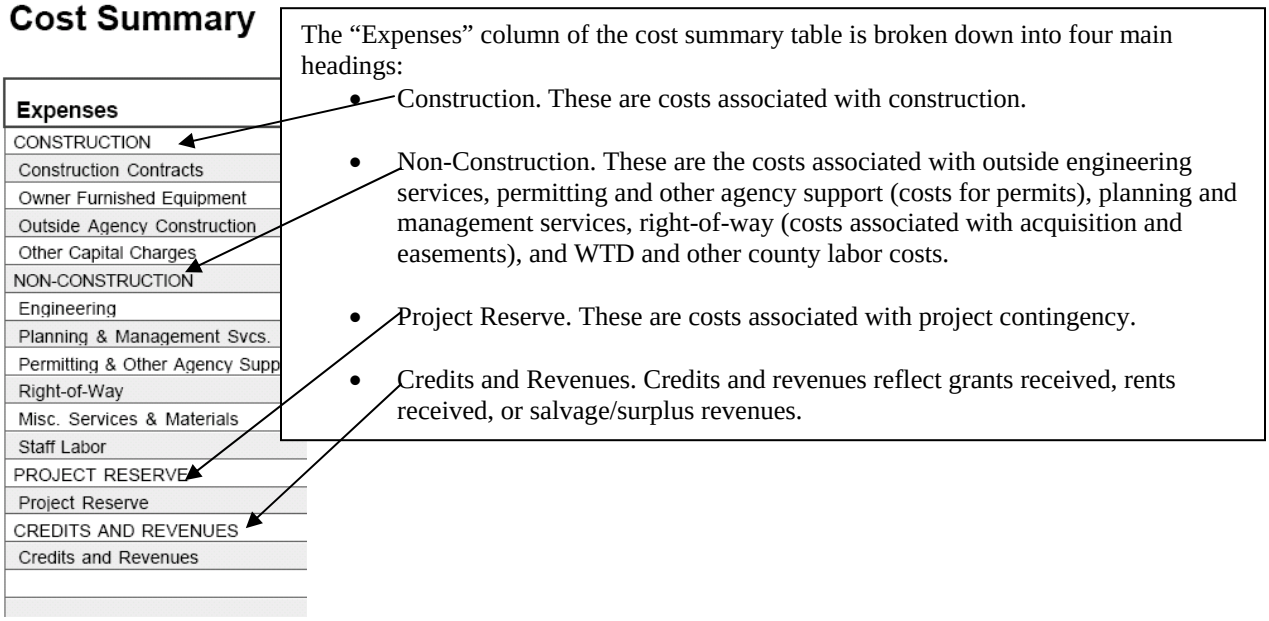
The cost summary table provides expenditure information for the year 2008 and lifetime budget information based on the adopted 2008 budget. An example of a project cost summary table and an explanation of how to read the summary follows.

Cost Summary

	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
Expenses	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	5,181,926	6,855,577	6,240,795	24,079,694	26,612,848	26,112,633
Construction Contracts	5,122,923	6,477,935	5,780,154	23,973,012	25,738,339	25,604,314
Owner Furnished Equipment	79		0	568		490
Outside Agency Construction		377,642	460,641	0	861,999	460,641
Other Capital Charges	58,925	0	0	106,114	12,510	47,189
NON-CONSTRUCTION	1,742,974	1,748,850	2,277,326	11,873,492	12,016,804	12,577,150
Engineering	275,131	327,147	538,041	4,786,339	4,996,517	5,049,249
Planning & Management Svcs.	388,883	575,231	844,848	1,191,417	1,690,859	1,647,383
Permitting & Other Agency Support	25,401	15,535	39,267	1,304,563	1,302,019	1,318,429
Right-of-Way	42,691	33,774	32,790	259,699	216,196	249,798
Misc. Services & Materials	97,324	71,842	69,750	449,701	382,389	422,127
Staff Labor	913,544	725,321	752,630	3,881,772	3,428,823	3,890,164
PROJECT RESERVE		0	29,127	0	268,342	125,752
Project Reserve		0	29,127	0	268,342	125,752
CREDITS AND REVENUES		-220,052	-337,590	0	-433,694	-337,590
Credits and Revenues		-220,052	-337,590	0	-433,694	-337,590
Total $	6,924,900	8,384,375	8,209,658	35,953,185	38,464,299	38,477,946

Cost/Budget Adjustments

An explanation of significant cost/budget adjustments, if any, is provided in this area; if there are none, this area is left blank.



2008 Actual Expenditure and Plan		
IBIS YTD Dec-08	Adopted Plan	Updated Plan
5,181,926	6,855,577	6,240,795
5,122,923	6,477,935	5,780,154
79		0
	377,642	460,641
58,925	0	0
1,742,974	1,748,850	2,277,326
275,131	327,147	538,041
388,883	575,231	844,848
25,401	15,535	39,267
42,691	33,774	32,790
97,324	71,842	69,750
913,544	725,321	752,630
	0	29,127
	0	29,127
	-220,052	-337,590
	-220,052	-337,590
6,924,900	8,384,375	8,209,658

The columns under "2008 Annual Expenditure and Plan" of the cost summary table reflect expenditures for 2008. The three headings under annual expenditures include:

- **IBIS* YTD (Year-to-Date) Dec-08**. This column reflects the actual expenditures for the year 2008, from January through December 2008.
- **Adopted Plan**. The costs in this column reflect the approved appropriation and breakdown by expense category for the year 2008.
- **Updated Plan**. The costs in this column reflect what was anticipated to be expended of the 2008 King County Council-approved project budget in preparation for the 2009-2014 budget submittal. Project managers begin developing their project budget submittals nine months before a budget is adopted and appropriated. Changes may occur from the time a budget is developed as compared to the actual budget year. Such changes may result from new information that could affect the project's scope or schedule, construction delays, or permitting and environmental review complexities.

* IBIS refers to King County's financial reporting system.

Lifetime Actual Expenditure and Budget		
IBIS LTD Dec-08	Lifetime Budget	Updated Budget
24,079,694	26,612,848	26,112,633
23,973,012	25,738,339	25,604,314
568		490
0	861,999	460,641
106,114	12,510	47,189
11,873,492	12,016,804	12,577,150
4,786,339	4,996,517	5,049,249
1,191,417	1,690,859	1,647,383
1,304,563	1,302,019	1,318,429
259,699	216,196	249,798
449,701	382,389	422,127
3,881,772	3,428,823	3,890,164
0	268,342	125,752
0	268,342	125,752
0	-433,694	-337,590
0	-433,694	-337,590
35,953,185	38,464,299	38,477,946

The columns under "Lifetime Actual Expenditure and Budget" of the cost summary table include the following columns:

- **IBIS LTD (Life-to-Date) Dec-08**. The costs in this column refer to total project expenditures through December 2008.
- **Lifetime Budget**. The costs in this column refer to projected total inflated project costs as adopted in the 2008-2013 budget (November 2007).
- **Updated Budget**. The costs in this column reflect the projected total inflated project costs as adopted in the 2009-2014 budget (November 2008). As noted earlier, project managers begin developing their project budget submittals around nine months before a budget is adopted and appropriated. The next year's (2009) budget submittal takes into account changes to the project scope or schedule, or new information identified since the current year's (2008) budget was adopted.

Contract Status

The third page of each project report includes information on contract status, if there are contracts associated with the project.

The contract status table provides the name of the contract, the original contract amount, amounts associated with amendments or change orders, and percentage paid of contract. The "Phased Amends" column refers to additional planned phases of the contract; the value of those planned phase amendments are included in the "Base Contract Amount" column. If work

associated with the contract was not planned when the original contract was signed, the costs associated with that work is seen in the "Change Amends or COs" column.[2]

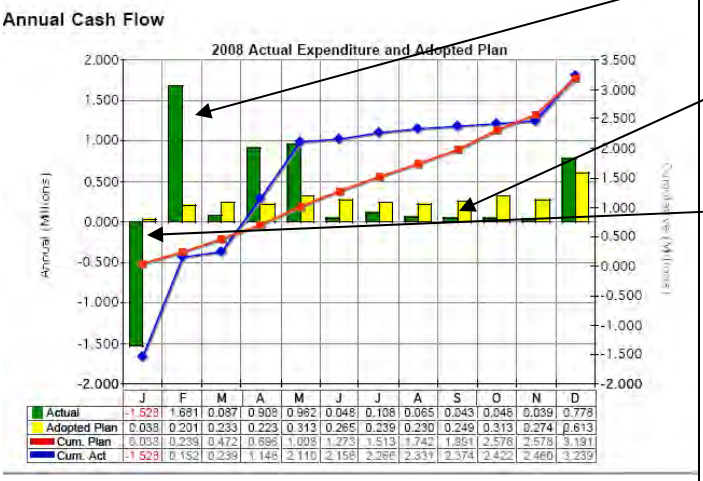
An example of the contract status table follows.

Contract Status

Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Hidden Lake Project C53108C	$20,929,000	$0	$20,929,000	$863,039	4%	8	$21,792,039	$16,297,043	17	75%
Hidden Lake Pump Station E03036E	$2,699,191	$0	$2,699,191	$2,381,297	88%	5	$5,080,487	$4,354,842	61	86%
Construction Management Services for the Hidden P43017P	$1,500,177	$0	$1,500,177	-$242,947	-16%	2	$1,257,230	$364,938	13	29%
Mitigation for Hidden Lk PS and boeing Creek Trunk Sewer MOA 3415	$1,100,000	$0	$1,100,000	$0	0%		$1,100,000	$1,100,000	1	100%

Annual Cash Flow

A chart depicting annual cash flow for each project is shown on page 3 of the report. This chart provides information on actual expenditures for 2008 monthly and cumulatively as compared to planned expenditures.



Actual expenditures by month. The bar on the left reflects the actual expenditures that took place in the indicated month.

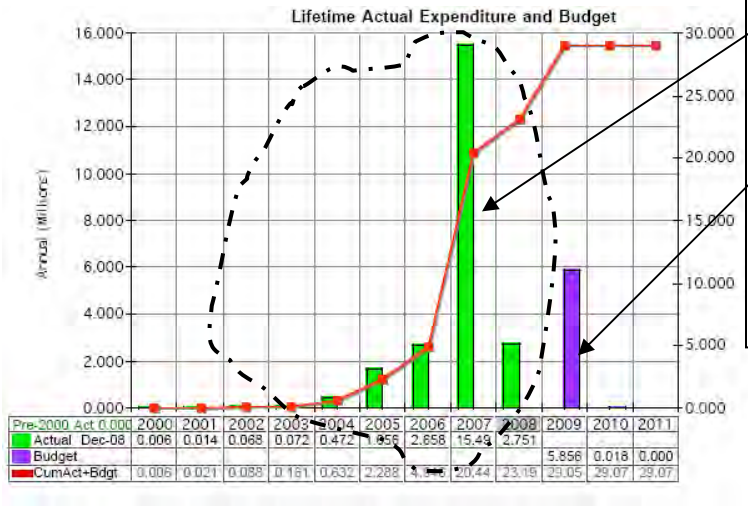
Planned expenditures by month. The bar on the right reflects the planned expenses for the indicated month.

Accrued costs. As part of the year-end accounting closure process to comply with generally accepted accounting principles, King County requires that goods and services received in the end of the calendar year (usually just December), which has been fully completed and for which payment obligation has been incurred, be accrued to the year those cost obligations were incurred. This results in a charge of the estimated accruals to the closing year and a corresponding negative offsetting charge in the January expenditures of the next year. Unlike all other months where expenditures shown are based on actual payments made, the December/January transition shows expenses on an accrual basis. Because accrued costs are shown as expenses in the closed year and not shown as expenses in the new year, the reporting result for project cost-tracking is (1) relatively higher than planned expenditures will be shown in December and (2) relatively lower than planned expenditures will be shown in January.

[2] "COs" refers to change orders.

Lifetime Cash Flow

A chart depicting the lifetime cash flow for each project is shown on page 4 of the report. This chart shows annual expenditures through 2008 and budgeted expenditures beyond 2008.



Actual annual expenditures. The bars through 2008 (inside the dashed line) reflect the annual expenditures have occurred for the project.

Budgeted. The bars in the columns 2009 and beyond reflect the anticipated future annual expenditures as adopted in the 2008-2013 budget (November 2007).

RWSP Project Report
DECEMBER 2008

423484 Brightwater Treatment Plant

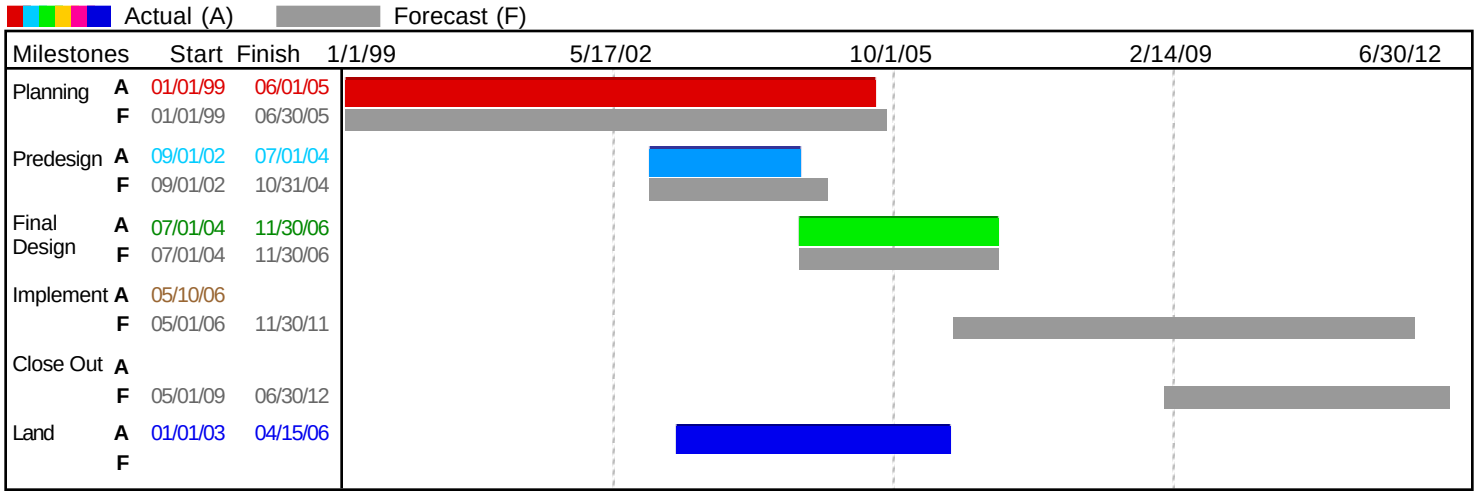
Project Description

This project will design and construct a treatment plant to provide 36 million gallons per day (mgd) of treatment capacity (average wet weather flow) by 2011 and 54 mgd of capacity by 2040. The Brightwater Treatment Plant will be located just east of State Route 9 and north of State Route 522 and Woodinville. Treatment and support facilities will cover approximately 43 acres (with additional area for stormwater treatment, open space, wildlife habitat and wetlands). The Brightwater plant will include membrane bioreactor secondary treatment systems, Class B biosolids, Class A reclaimed water production, odor control systems, and disinfection.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Due to slower than planned tunnel construction on the Central Tunnel, the initiation of wastewater is now projected to be September 2011.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	132,914,380	127,526,188	115,987,170	191,275,297	530,713,965	550,931,422
Construction Contracts	124,246,713	121,689,534	107,357,780	176,544,094	506,833,207	503,688,902
Owner Furnished Equipment	1,827,967	837,910	3,595,407	1,872,182	7,216,824	28,545,396
Outside Agency Construction	4,556,884	2,250,000	2,636,000	4,679,419	4,562,699	6,794,734
Other Capital Charges	2,282,815	2,748,744	2,397,984	8,179,601	12,101,235	11,902,390
NON-CONSTRUCTION	32,685,996	27,437,934	33,112,893	295,308,000	315,812,250	325,617,693
Engineering	4,601,518	2,300,484	5,326,412	65,830,741	66,328,597	76,494,769
Planning & Management Svcs.	4,443,495	3,088,440	3,964,812	18,743,386	26,331,979	27,734,228
Permitting & Other Agency Support	-1,398,015	1,523,644	1,334,000	4,437,749	8,081,476	9,932,120
Right-of-Way	21,529,117	17,300,002	19,547,566	180,807,956	183,749,283	179,662,490
Misc. Services & Materials	267,511	283,074	277,623	4,170,264	4,473,838	4,747,171
Staff Labor	3,242,369	2,942,290	2,662,480	21,317,903	26,847,077	27,046,915
PROJECT RESERVE		0	0	0	4,000,000	2,000,000
Project Reserve		0	0	0	4,000,000	2,000,000
CREDITS AND REVENUES	-65,723	-7,981,876	-200,000	-3,101,137	-10,606,932	-3,235,415
Credits and Revenues	-65,723	-7,981,876	-200,000	-3,101,137	-10,606,932	-3,235,415
Total $	165,534,653	146,982,246	148,900,064	483,482,159	839,919,283	875,313,700

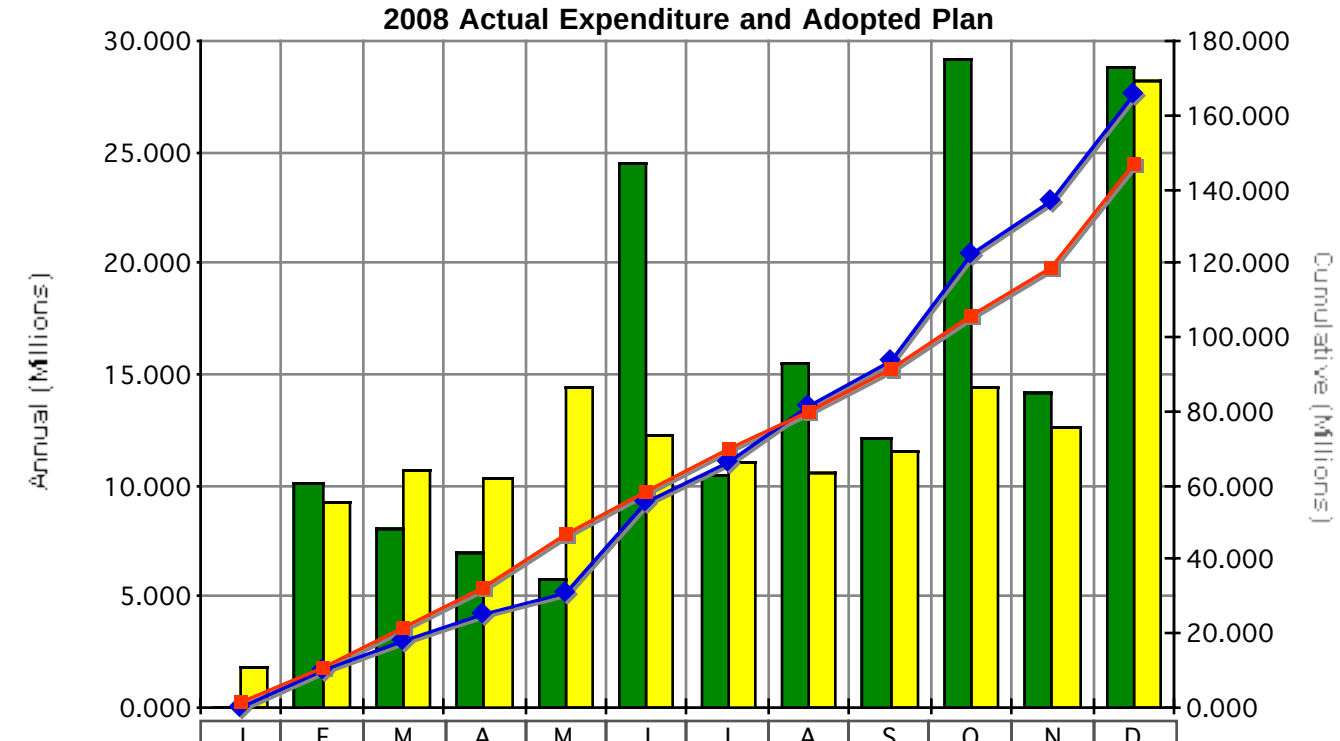
Cost/Budget Adjustments

A detailed explanation of Brightwater cost changes is contained in the annual Brightwater Cost Update (Trend Report).

Contract Status

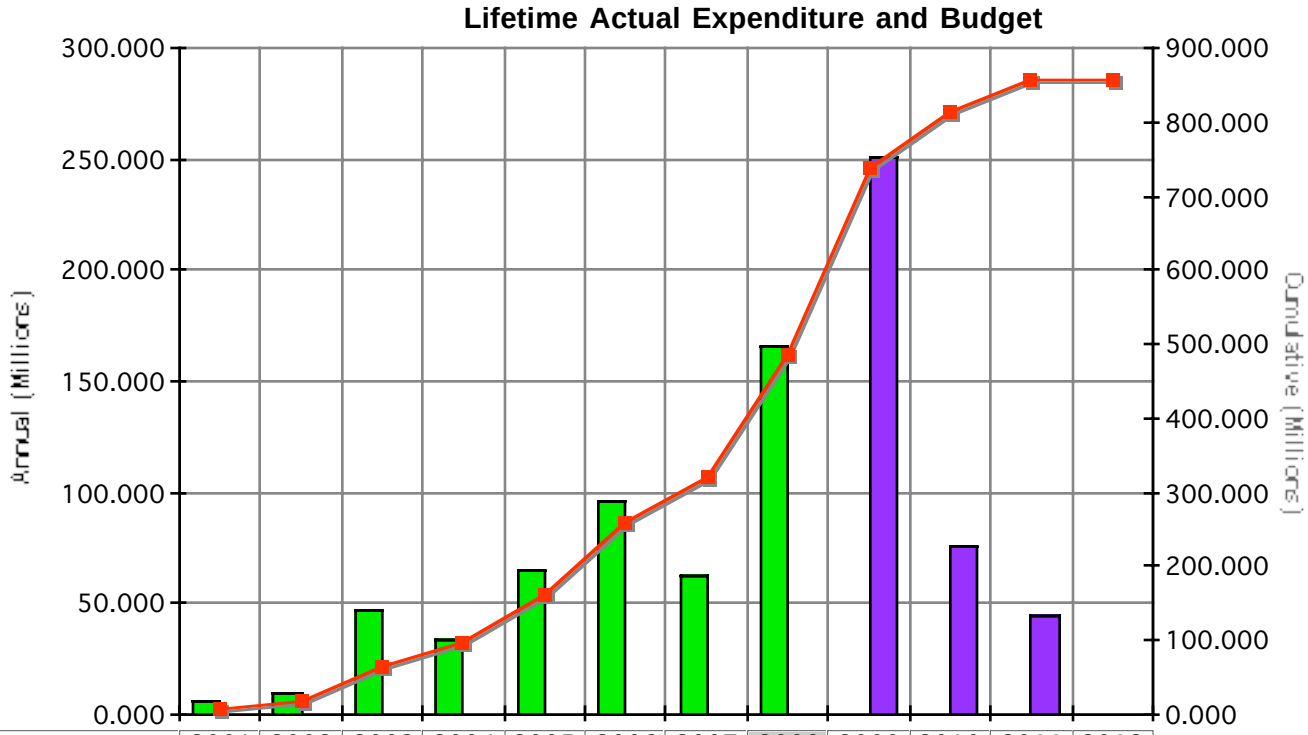
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Brightwater Treatment Plant Solids / Odor Control Facilities C00168C07	$166,459,000	$0	$166,459,000	$153,773	0%	2	$166,612,773	$22,970,572	10	14%
Engineering Services for Brightwater Treatment Plant E13035E	$9,719,364	$51,086,355	$60,805,719	$16,756,480	28%	39	$77,562,199	$65,113,042	424	84%
RWSP Program Management Services Development P03012P	$8,205,521	$0	$8,205,521	$1,245,617	15%	4	$9,451,138	$9,451,138	48	100%
North Treatment Facilities Site Selection P93012P	$4,617,000	$0	$4,617,000	$7,629,920	165%	12	$12,246,920	$12,001,214	71	98%
Architectural, Landscape Arch & Interior Design Svcs/Brightwater E23002E	$4,401,280	$0	$4,401,280	$39,338	1%	2	$4,440,618	$4,363,046	21	98%
Brightwater Legal Services Agreement/Brightwater legal Svcs	$3,500,000	$0	$3,500,000	$0	0%		$3,500,000	$271,109	21	8%
NTF Marine Outfall Siting Study P93009P	$1,534,999	$0	$1,534,999	$1,518,159	99%	4	$3,053,159	$3,053,159	53	100%
Construction Management Services for the Treatment Plant P53007P	$1,497,206	$12,730,520	$14,227,726	$298,711	2%	6	$14,526,437	$5,813,583	80299826	40%
GCCM Contract for Brightwater C38138C	$1,424,428	$305,141,553	$306,565,981	$18,717,933	6%	44	$325,283,914	$129,429,166	131	40%
NTF Legal Services T01129T	$1,150,000	$2,150,000	$3,300,000	$0	0%	4	$3,300,000	$2,930,867	63	89%
NTF Legal Services T01130T	$1,150,000	$2,864,700	$4,014,700	$0	0%	6	$4,014,700	$3,793,251	75	94%
Engrg & Design Svcs to Construct Electrical Infrastructure Agreement 299593	$157,500	$0	$157,500	$388,700	247%		$546,200	$480,766	17	88%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.034	10.13	8.000	7.004	5.814	24.50	10.48	15.45	12.14	29.10	14.13	28.77
Adopted Plan	1.764	9.260	10.73	10.28	14.40	12.20	11.02	10.58	11.46	14.40	12.64	28.22
Cum. Plan	1.764	11.02	21.75	32.04	46.44	58.64	69.67	80.25	91.71	118.7	118.7	146.9
Cum. Act	0.034	10.17	18.17	25.17	30.99	55.49	65.98	81.43	93.58	122.6	136.8	165.6

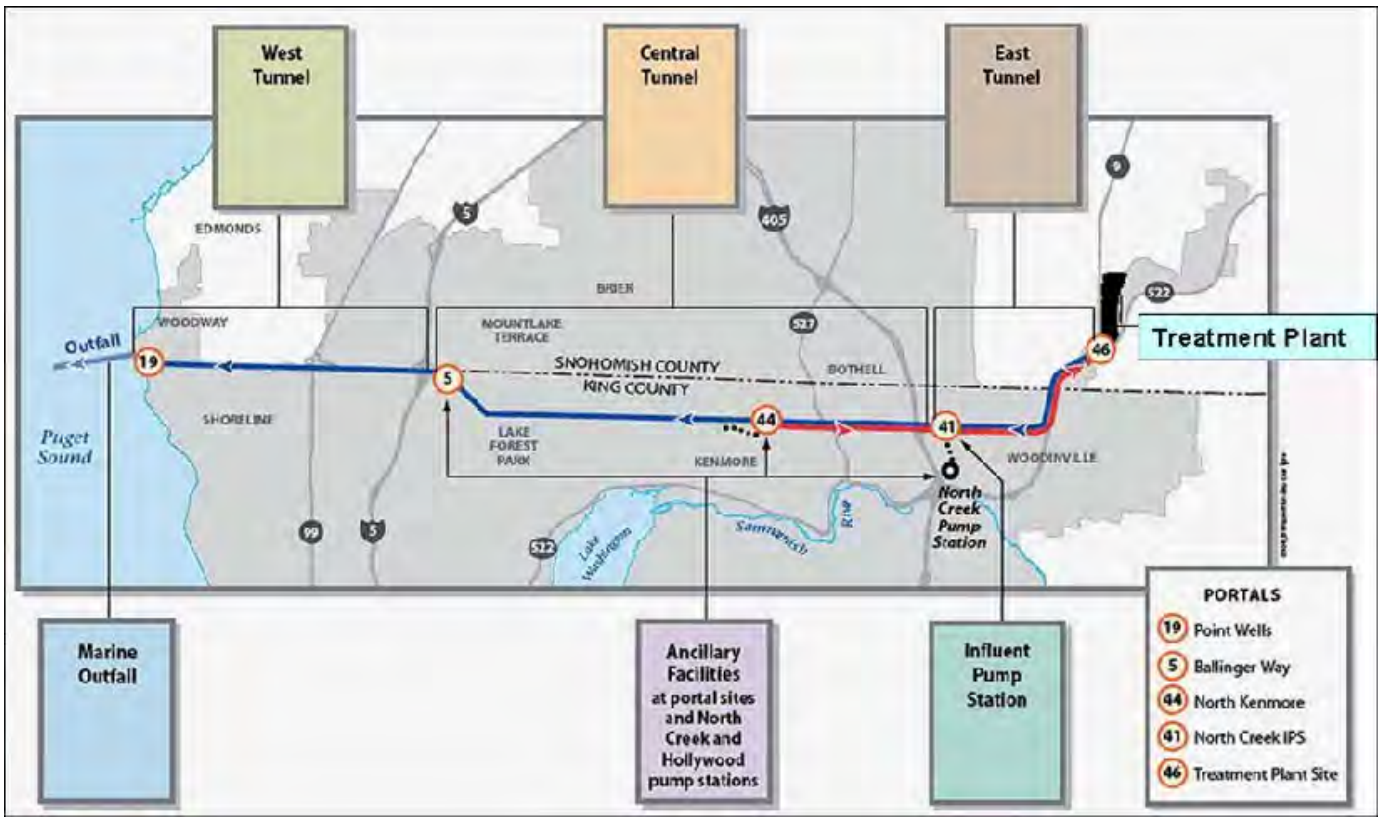
Lifetime Cash Flow



Pre-01 Act 2.615	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Actual Dec-08	5.441	9.675	46.92	33.54	64.34	95.68	62.75	165.6				
Budget									251.1	75.96	44.75	0.000
CumAct+Bdgt	8.055	17.73	64.65	98.19	162.5	258.2	320.9	486.5	737.6	813.6	858.4	858.4

RWSP Project Report
DECEMBER 2008

423575 Brightwater Conveyance



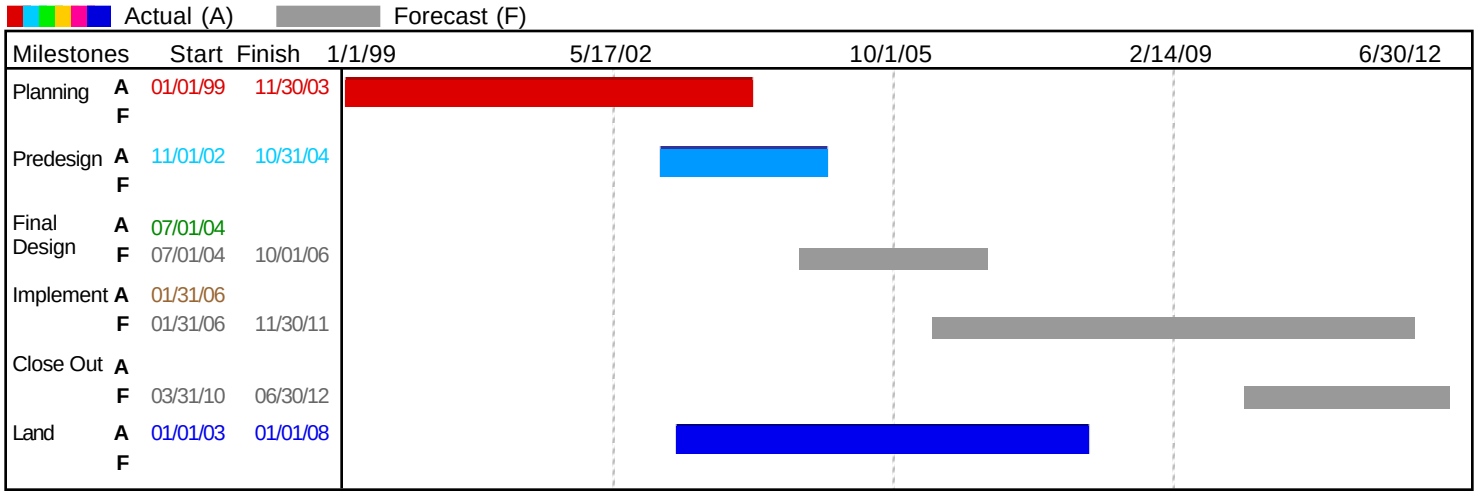
Project Description

This project will carry treated and untreated wastewater to and from the Brightwater Treatment Plant located north of Woodinville along State Route 9. The Brightwater project will serve south Snohomish County and north King County once it becomes operational in late 2011. The conveyance system includes 13.9 miles of pipeline built in underground tunnels. Some portions of the tunnel will contain up to four pipes going to and from the treatment plant while other tunnel sections will contain only a single pipeline that will carry highly treated effluent to Puget Sound, which will be discharged through a new outfall located one mile offshore of Point Wells.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Due to slower than planned tunnel construction on the Central Tunnel, the initiation of wastewater is now projected to be September 2011.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	180,213,682	180,405,778	192,911,738	364,892,825	713,354,996	723,478,824
Construction Contracts	175,944,076	175,643,590	187,802,187	347,264,574	690,391,721	699,506,001
Owner Furnished Equipment	301,331	0	358,528	389,330	87,999	695,672
Outside Agency Construction	414,759	1,183,479	1,183,479	2,864,206	5,056,347	5,999,885
Other Capital Charges	3,553,516	3,578,709	3,567,544	14,374,715	17,818,930	17,277,266
NON-CONSTRUCTION	24,017,273	19,498,108	21,489,137	168,418,472	196,062,640	197,243,280
Engineering	5,470,809	2,872,477	5,711,096	72,792,491	70,005,067	76,834,883
Planning & Management Svcs.	12,582,969	10,498,200	8,875,571	40,325,359	57,595,909	53,820,097
Permitting & Other Agency Support	-649,063	2,150,643	2,250,643	1,020,695	13,304,695	6,071,042
Right-of-Way	3,122,494	0	1,000,000	25,939,916	18,933,999	23,817,422
Misc. Services & Materials	65,238	540,095	455,289	3,997,488	5,261,277	5,467,728
Staff Labor	3,424,825	3,436,694	3,196,539	24,342,524	30,961,693	31,232,108
PROJECT RESERVE		0	0	0	18,200,829	6,200,829
Project Reserve		0	0	0	18,200,829	6,200,829
CREDITS AND REVENUES	1,749	0	0	-4,666	-5,351	-6,415
Credits and Revenues	1,749	0	0	-4,666	-5,351	-6,415
Total $	204,232,705	199,903,886	214,400,876	533,306,631	927,613,115	926,916,518

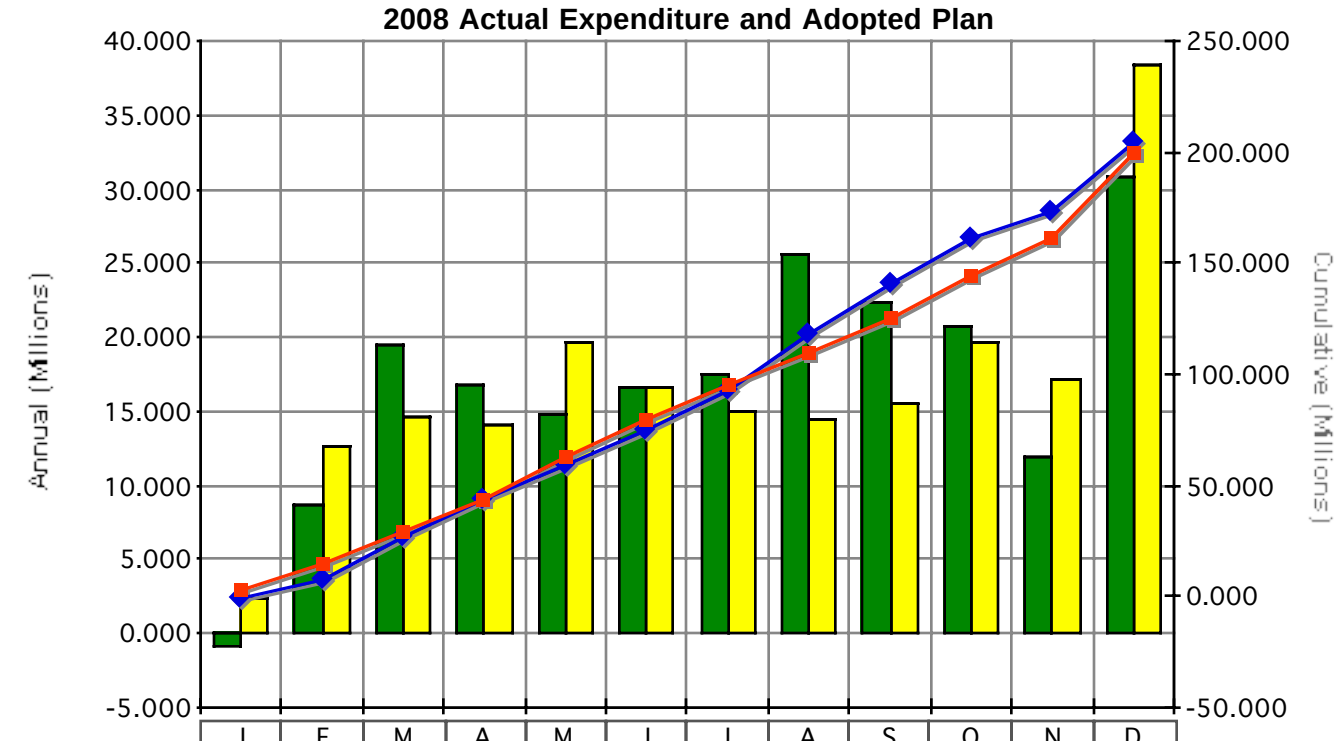
Cost/Budget Adjustments

A detailed explanation of Brightwater cost changes is contained in the annual Brightwater Cost Update (Trend Report).

Contract Status

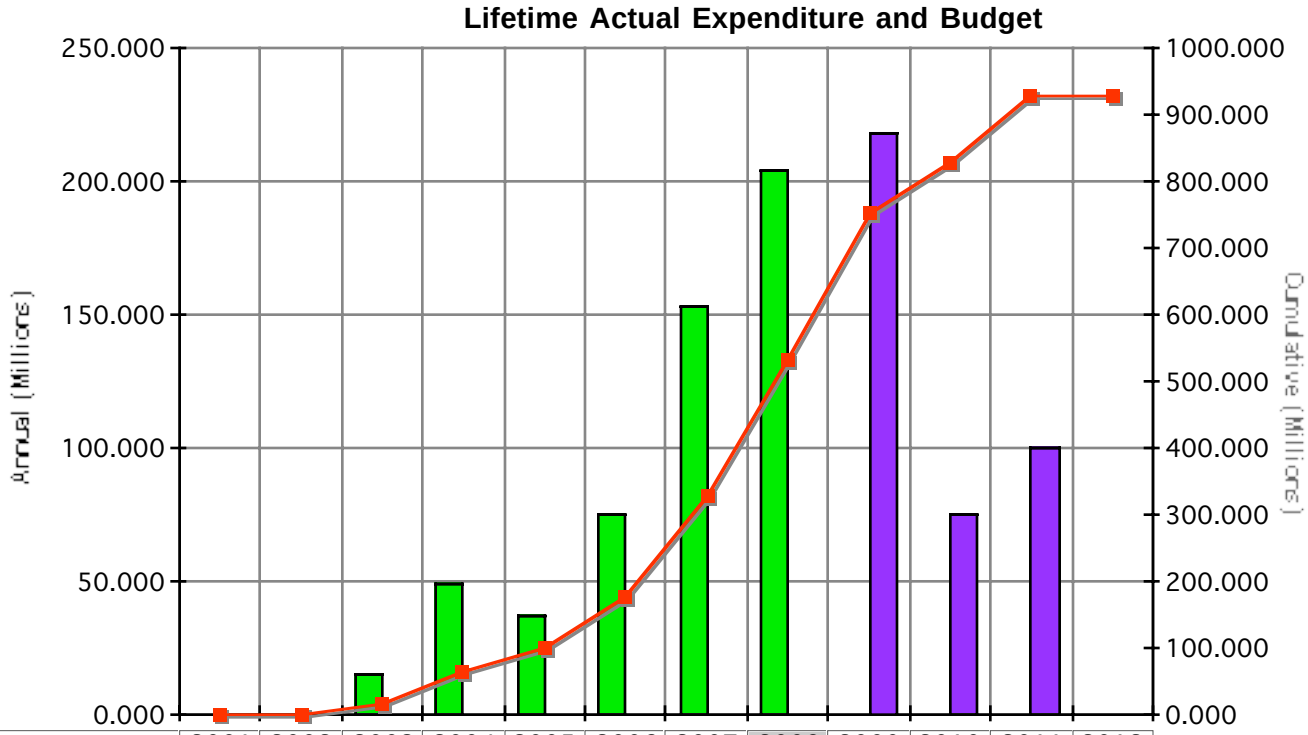
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Brightwater Conveyance Sys, Central Contract, BW Tunnel,	$211,076,058 C00005C06	$0	$211,076,058	$3,281,418	2%	11	$214,357,476	$122,006,800	38	57%
East Combined Tunnel	$130,848,750 C53060C	$0	$130,848,750	$4,285,376	3%	13	$135,134,126	$105,107,572	44	78%
Brightwater Conveyance System - West Contract	$102,453,000 C00007C06	$0	$102,453,000	$4,555,616	4%	6	$107,008,616	$54,514,172	20	51%
Brightwater Influent Pump Station	$91,860,000 C00002C06	$0	$91,860,000	$70,944	0%	2	$91,930,944	$3,948,778	17	4%
Brightwater Conveyance Marine Outfall	$27,599,800 E58016E	$0	$27,599,800	$2,132,777	8%		$29,732,577	$28,444,224	15	96%
CM Services for BW Conveyance	$13,327,255 P43020P	$16,687,974	$30,015,229	$2,295,318	8%	4	$32,310,547	$21,799,483	45	67%
Geotechnical Services for the Brightwater Conveyance	$11,474,386 E23007E	$10,386,010	$21,860,396	$368,876	2%	5	$22,229,272	$16,572,269	693	75%
Engineering Svcs for the Brightwater Conveyance Sys	$11,217,376 E23006E	$0	$11,217,376	$0	0%	5	$11,217,376	$10,921,533	36	97%
Brightwater Conveyance	$11,173,313 E33015E/A	$2,291,578	$13,464,890	$0	0%	1	$13,464,890	$12,734,402	53	95%
Brightwater Conveyance System North Creek Facilities	$10,180,000 C00063C06	$0	$10,180,000	$133,012	1%	3	$10,313,012	$9,483,706	12	92%
Prof Svcs for Brightwater Conveyance Final Design	$7,167,571 E33015E/C	$1,581,546	$8,749,117	$0	0%	1	$8,749,117	$7,510,196	53	86%
Prof Svcs for Brightwater Conveyance Final Design	$5,672,837 E33015E/B	$1,234,040	$6,906,877	$0	0%	1	$6,906,877	$5,076,827	53	74%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.844	8.666	19.48	16.73	14.71	16.56	17.41	25.64	22.43	20.68	11.96	30.78
Adopted Plan	2.399	12.59	14.59	13.99	19.59	16.59	14.99	14.39	15.59	19.59	17.19	38.38
Cum. Plan	2.399	14.99	29.58	43.57	63.17	79.76	94.75	109.1	124.7	161.5	161.5	199.9
Cum. Act	-0.844	7.822	27.30	44.03	58.74	75.30	92.72	118.3	140.7	161.4	173.4	204.2

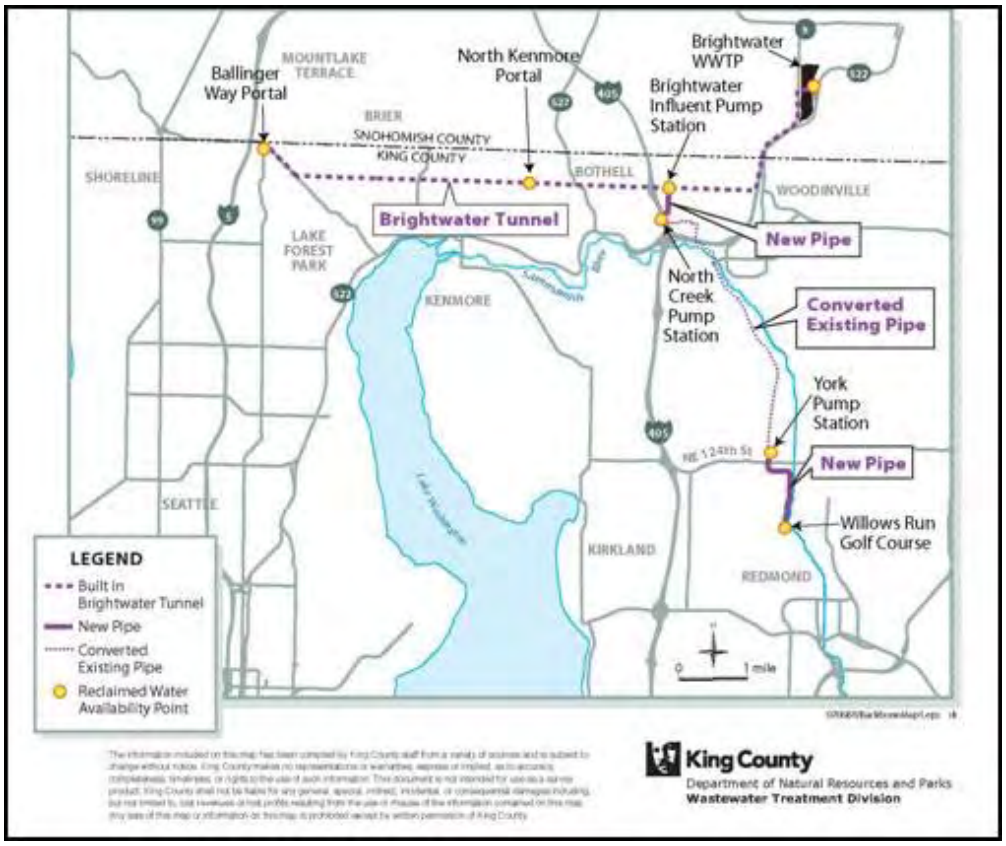
Lifetime Cash Flow



Pre-01 Act 0.000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Actual Dec-08			14.90	49.22	36.97	74.65	153.3	204.2				
Budget									217.7	75.43	99.97	0.000
CumAct+Bdgt	0.000	0.000	14.90	64.13	101.1	175.7	329.0	533.3	751.0	826.4	926.4	926.4

RWSP Project Report
DECEMBER 2008

423600 Brightwater Reclaimed Water Pipeline

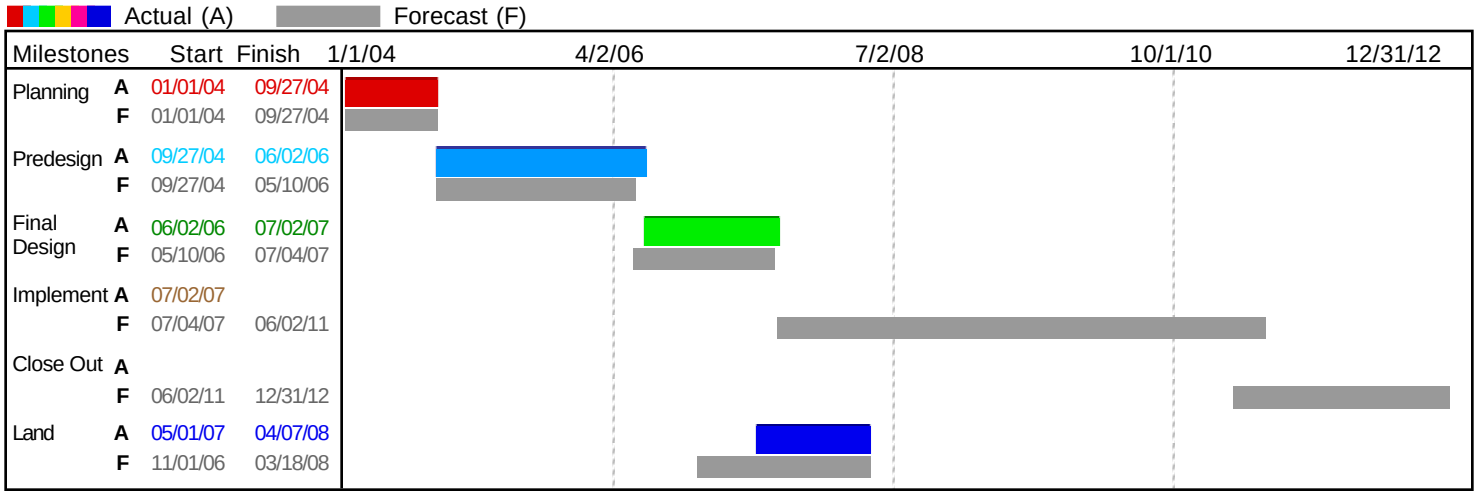


Project Description

This project will convey Class A reclaimed water produced at the Brightwater Treatment Plant to the Sammamish Valley and to potential customers along the effluent pipeline system starting in 2011. The system initially will provide up to 7 million gallons per day of reclaimed water to the Sammamish Valley area by gravity flow.

Project Phase: 4 Implementation

Milestone Schedule



Schedule Adjustments

Cost Summary

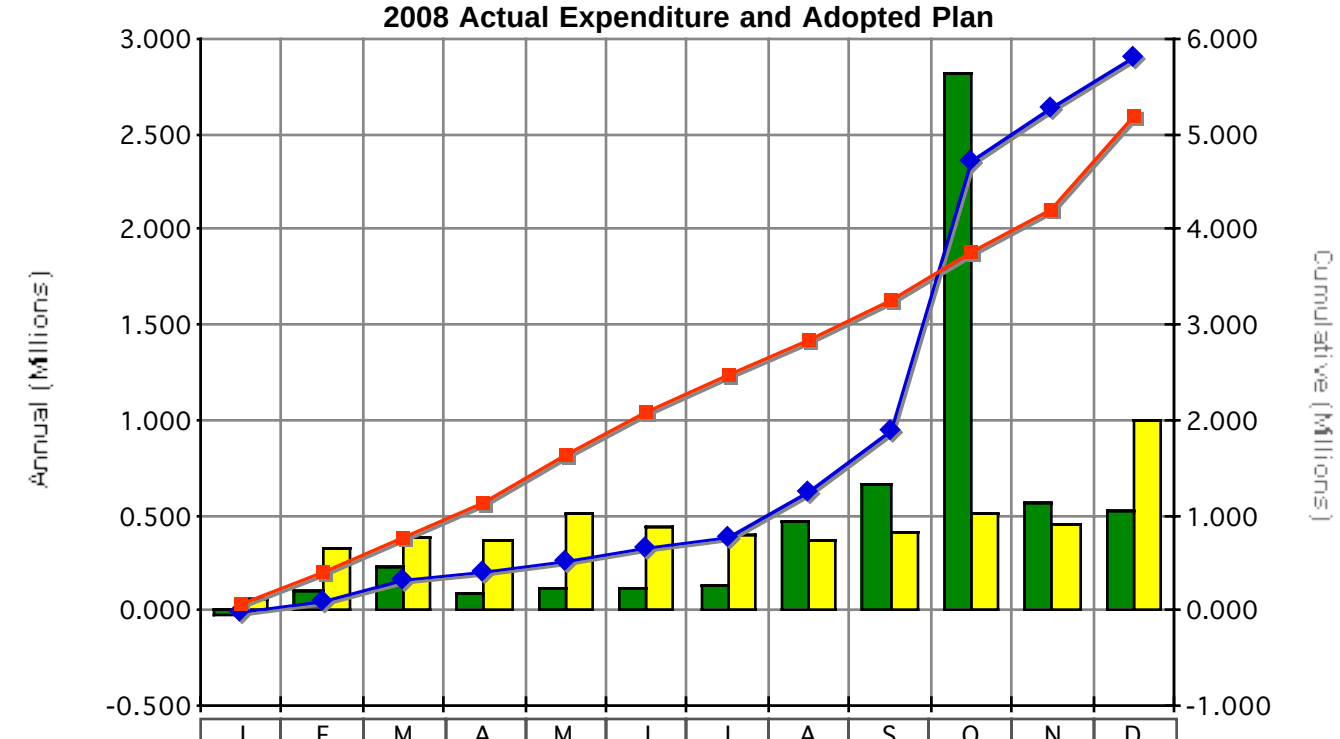
Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	4,329,120	3,533,086	4,623,453	5,403,561	13,967,002	14,174,586
Construction Contracts	4,329,120	3,533,086	4,623,453	5,392,889	13,880,602	13,921,143
Owner Furnished Equipment	0		0	10,413		10,413
Other Capital Charges	0	0	0	259	86,400	243,030
NON-CONSTRUCTION	1,465,949	1,667,122	1,678,379	4,482,534	8,318,521	8,145,718
Engineering	678,247	900,045	782,335	2,579,992	3,830,097	3,705,389
Planning & Management Svcs.	58,178	51,500	180,495	58,178	310,693	918,902
Permitting & Other Agency Support	17,273	36,050	35,000	58,564	128,182	97,200
Right-of-Way	10,935	103,000	131,110	23,635	289,522	318,797
Misc. Services & Materials	74,708	35,665	34,627	131,896	188,331	177,293
Staff Labor	626,608	540,861	514,813	1,630,268	3,571,696	2,928,137
PROJECT RESERVE		0	0	0	4,730,517	4,593,499
Project Reserve		0	0	0	4,730,517	4,593,499
Total $	5,795,068	5,200,208	6,301,832	9,886,095	27,016,040	26,913,803

Cost/Budget Adjustments

Contract Status

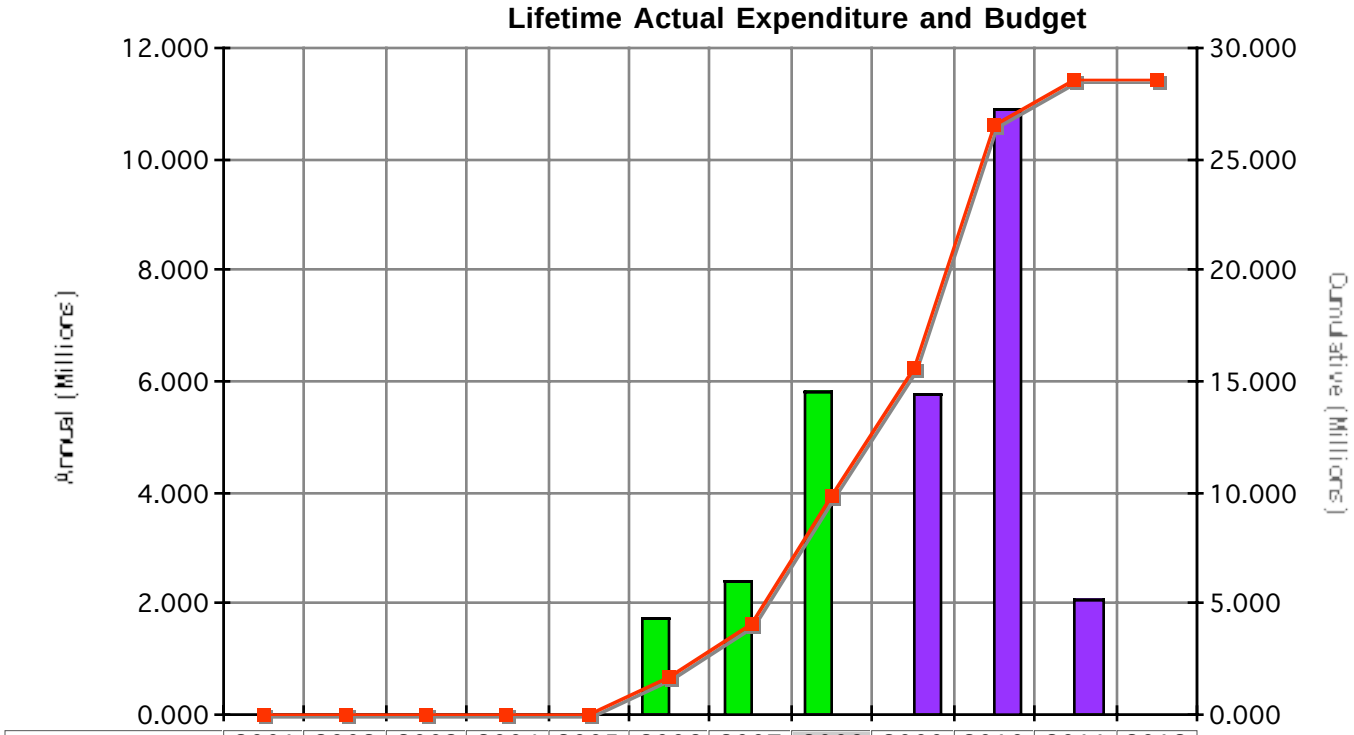
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Brightwater Reclaimed Water System Section 2 C00242C08	$6,647,320	$0	$6,647,320	$0	0%		$6,647,320	$2,302,735	2	35%
Brightwater Reclaimed Water Conveyance Facility E43010E	$1,918,771	$2,670,893	$4,589,664	$268,607	6%	6	$4,858,270	$3,433,716	211	71%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.018	0.096	0.233	0.088	0.123	0.119	0.135	0.462	0.655	2.823	0.563	0.516
Adopted Plan	0.062	0.328	0.380	0.364	0.510	0.432	0.390	0.374	0.406	0.510	0.447	0.998
Cum. Plan	0.062	0.390	0.770	1.134	1.643	2.075	2.465	2.839	3.245	4.202	4.202	5.200
Cum. Act	-0.018	0.079	0.312	0.400	0.522	0.641	0.777	1.239	1.894	4.717	5.279	5.795

Lifetime Cash Flow



Pre-01 Act 0.000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Actual Dec-08						1.705	2.386	5.795				
Budget									5.766	10.87	2.046	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	1.705	4.091	9.886	15.65	26.52	28.57	28.57

RWSP Project Report
DECEMBER 2008

423557 Carnation Treatment Plant

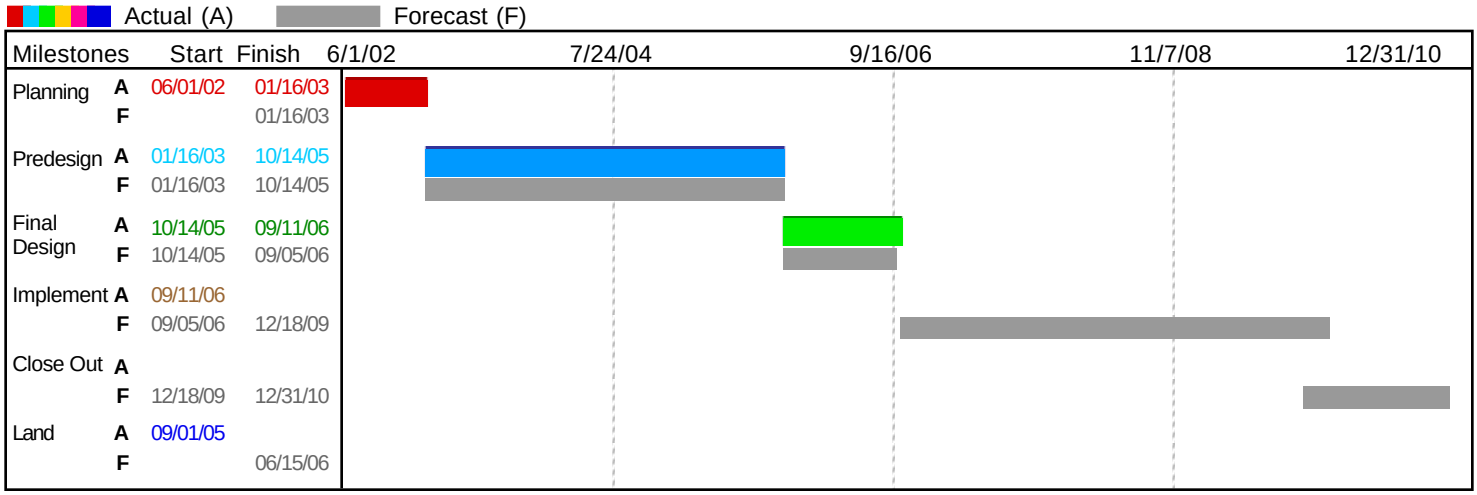
Project Description

The City of Carnation replaced its on-site septic systems with a centralized wastewater treatment and collection system to protect public health and the environment, achieve the city's comprehensive plan goals, and maintain and enhance community livability. The city was responsibile for the design, construction, and operation of the local wastewater collection system. The county was responsibile for the design, construction, and operation of the treatment plant, which is a 0.4 million gallons per day membrane bioreactor treatment plant. The treatment plant produces Class A reclaimed water that will be used to enhance existing wetlands at the Chinook Bend Natural Area. The treatment plant began operating in spring 2008.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	3,079,773	2,181,719	4,476,721	13,472,032	12,961,045	14,868,980
Construction Contracts	2,869,173	2,181,719	4,426,721	13,247,307	12,242,645	14,804,855
Owner Furnished Equipment	0	0	0	14,125	718,400	14,125
Outside Agency Construction	210,600	0	0	210,600	0	0
Other Capital Charges			50,000	0		50,000
NON-CONSTRUCTION	79,118	208,569	-64,479	7,389,400	6,689,950	7,260,620
Engineering	-849,460	94,737	-706,000	3,497,720	3,859,097	3,641,180
Planning & Management Svcs.	135,596	108,150	100,000	345,796	711,162	310,199
Permitting & Other Agency Support	2,986	0	20,000	192,522	211,619	209,536
Right-of-Way	0	0	0	402,863	464,602	402,863
Misc. Services & Materials	135,367	3,562	7,458	331,143	122,024	204,264
Staff Labor	654,627	2,120	514,063	2,619,356	1,321,446	2,492,578
PROJECT RESERVE			40,000	0		50,300
Project Reserve			40,000	0		50,300
Total $	3,158,891	2,390,288	4,452,243	20,861,432	19,650,995	22,179,900

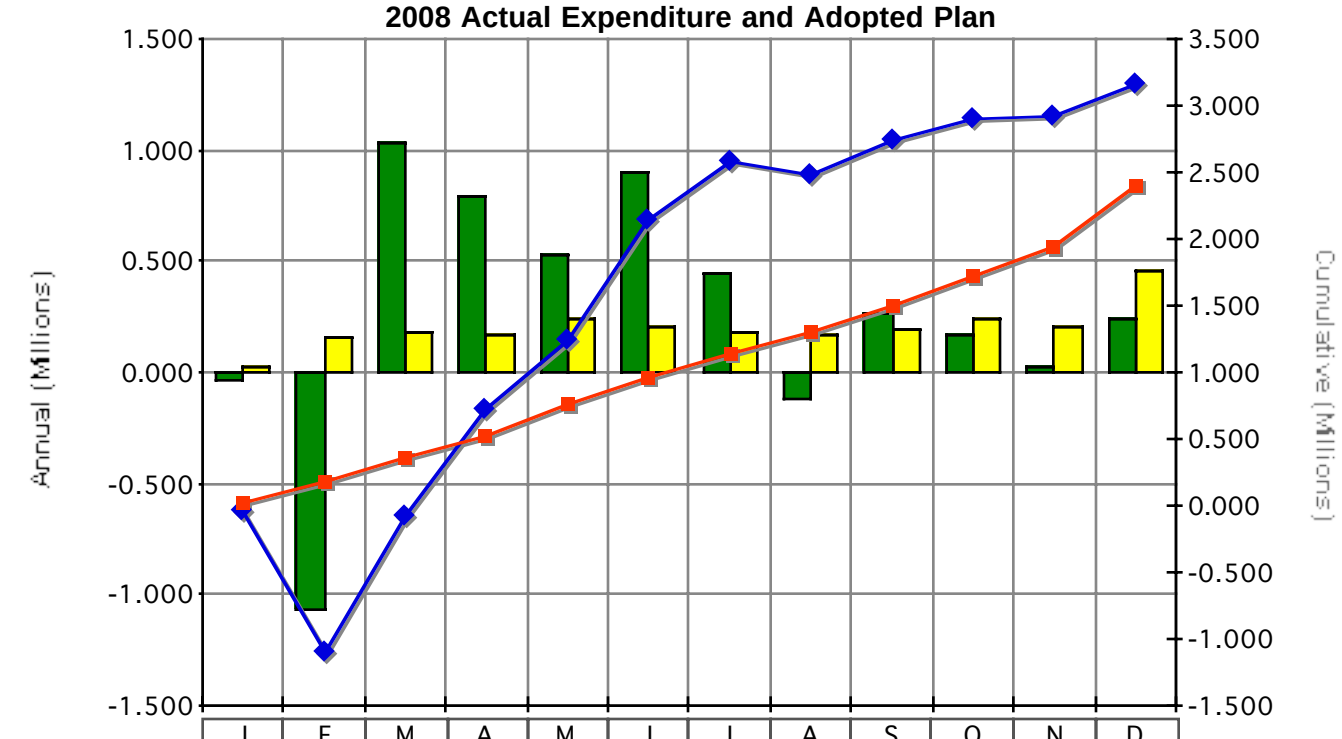
Cost/Budget Adjustments

The change in lifetime budget results from extending the project schedule to accommodate weather-related delays and equipment delivery delays and the need for minor engineering and construction improvements, which resulted in the need for additional project management and project control services.

Contract Status

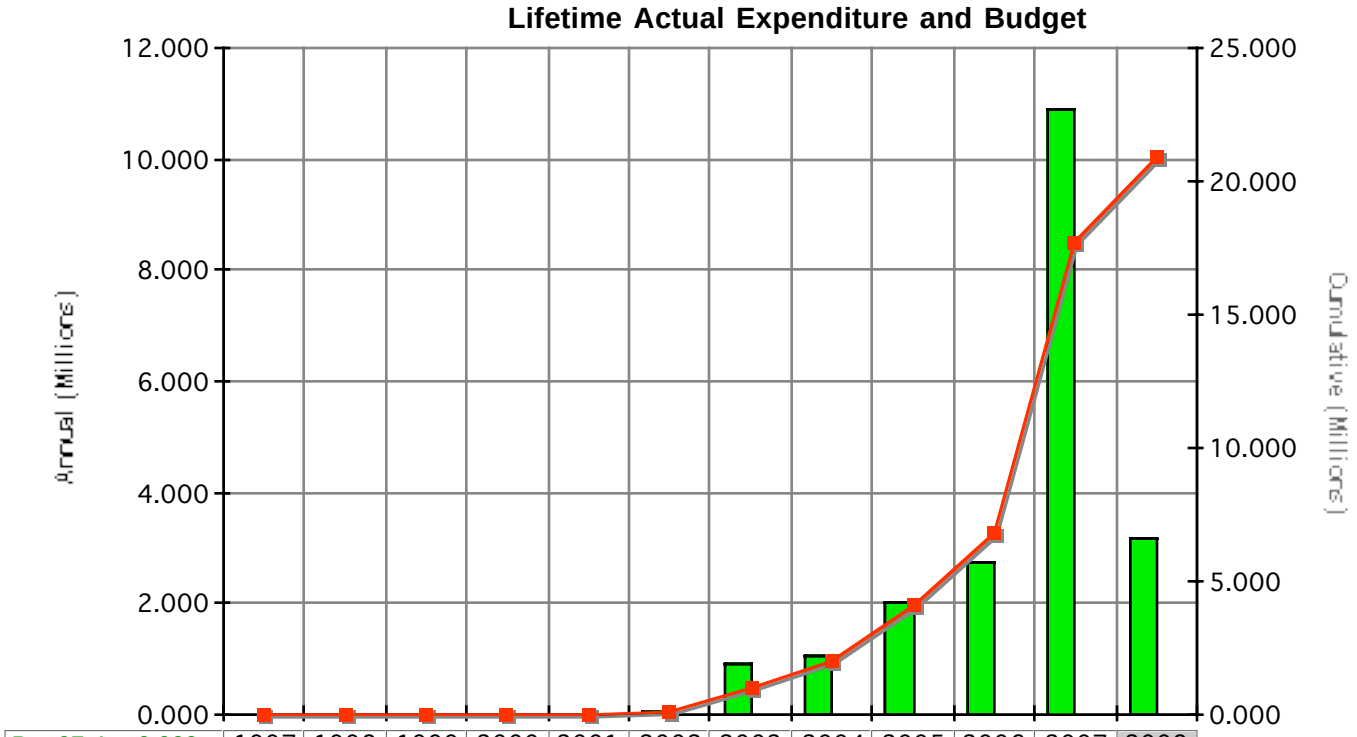
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Carnation Wastewater Treatment Facility C00036C06	$11,794,500	$995,500	$12,790,000	$530,571	4%	14	$13,320,571	$13,188,081	25	99%
Carnation Treatment Facility E23020E	$629,804	$3,414,299	$4,044,103	$309,337	8%	6	$4,353,440	$4,275,997	70	98%
Carnation WWTP Construction Management Services P00004P06	$610,919	$0	$610,919	$0	0%		$610,919	$606,221	20	99%
Professional Archaeological Services P43007P	$100,000	$0	$100,000	$0	0%		$100,000	$67,566	23	68%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.039	-1.066	1.027	0.788	0.529	0.903	0.443	-0.115	0.260	0.166	0.025	0.238
Adopted Plan	0.029	0.151	0.174	0.167	0.234	0.198	0.179	0.172	0.186	0.234	0.206	0.459
Cum. Plan	0.029	0.179	0.354	0.521	0.755	0.954	1.133	1.305	1.492	1.931	1.931	2.390
Cum. Act	-0.039	-1.104	-0.077	0.711	1.240	2.143	2.585	2.470	2.730	2.896	2.921	3.159

Lifetime Cash Flow



Pre-97 Act 0.000	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Dec-08						0.068	0.926	1.052	2.020	2.742	10.89	3.159
Budget												
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.068	0.994	2.046	4.066	6.807	17.70	20.86

RWSP Project Report
DECEMBER 2008

423611 Chinook Wetlands Enhancement

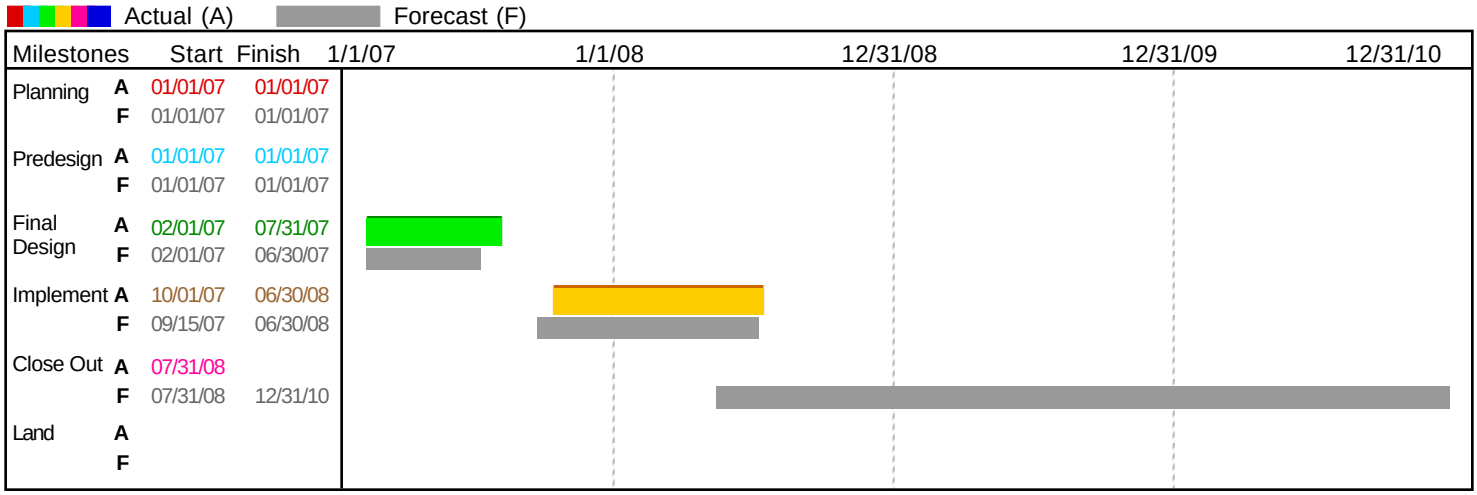
Project Description

This project will direct and discharge Class A reclaimed water produced by the Carnation Treatment Plant to the Chinook Bend Wetlands. This project is being done in collaboration with Ducks Unlimited. It includes the additional piping needed to bring reclaimed water to the wetland and improvements at the Carnation plant, such as additional ultraviolet disinfection equipment, to meet the reclaimed water requirements for a wetland discharge.

Project Phase: Complete

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

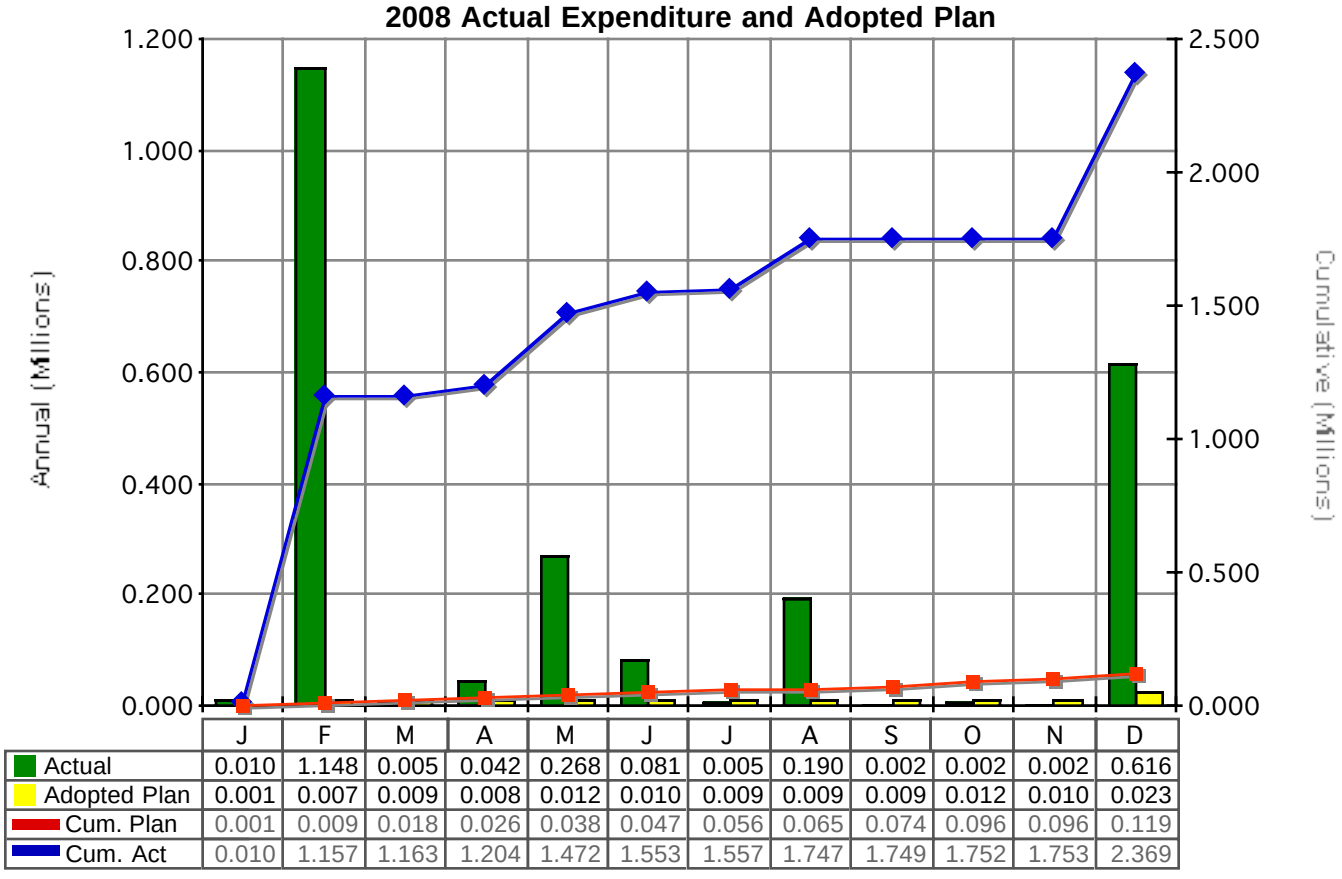
Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	1,139,355	8,755	559,450	1,405,650	828,068	825,744
Construction Contracts	1,139,355	8,755	559,450	1,405,650	828,068	825,744
NON-CONSTRUCTION	1,229,386	110,068	1,430,643	1,963,667	2,217,992	2,164,924
Engineering	1,151,970	1,889	1,140,000	1,265,207	1,207,000	1,253,237
Planning & Management Svcs.	7,515	0	70,000	7,725	34,300	70,210
Permitting & Other Agency Support	3,088	7,357	100,000	115,222	50,214	212,134
Misc. Services & Materials	1,220	0	0	34,719	11,941	33,500
Staff Labor	65,594	100,822	120,643	540,794	914,537	595,843
Total $	2,368,742	118,823	1,990,093	3,369,317	3,046,060	2,990,668

Cost/Budget Adjustments

Contract Status

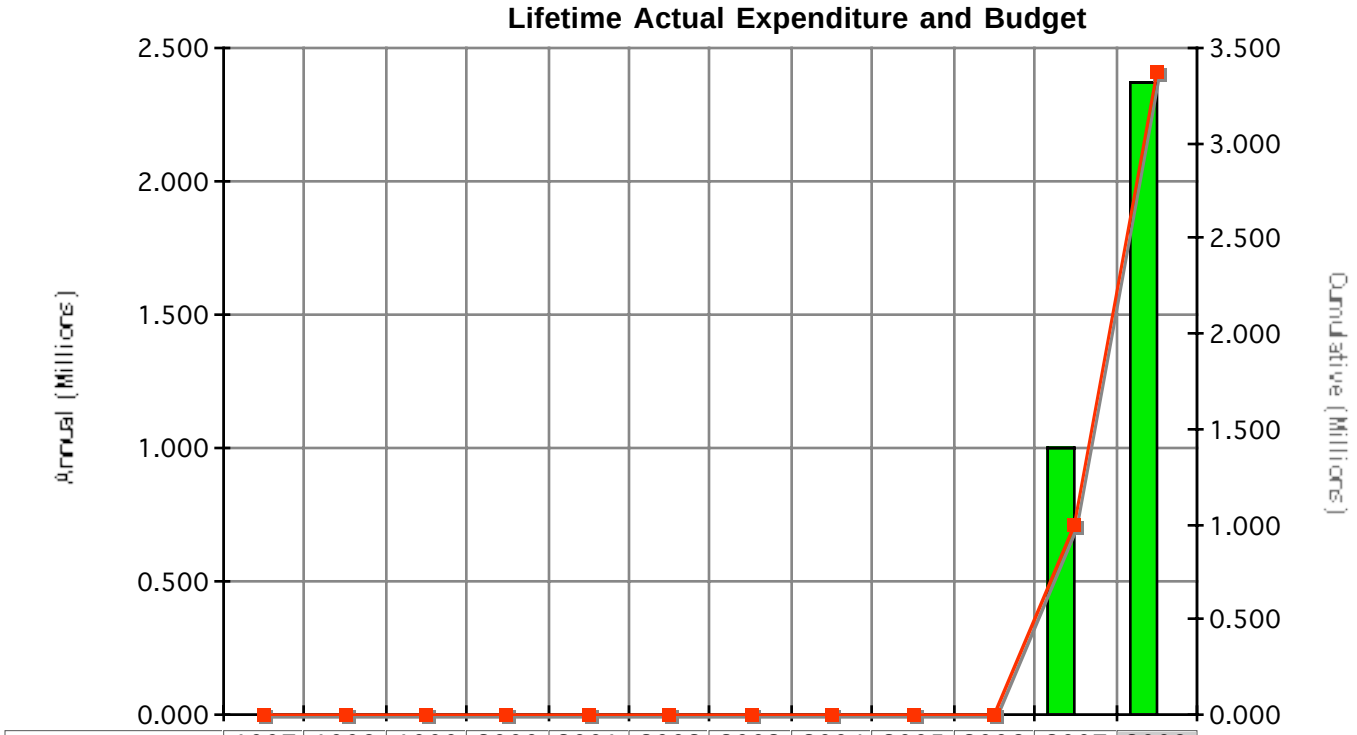
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Carnation Wastewater Treatment Facility C00036C06	$11,794,500	$995,500	$12,790,000	$530,571	4%	14	$13,320,571	$13,188,081	25	99%
Carnation Treatment Facility E23020E	$629,804	$3,414,299	$4,044,103	$309,337	8%	6	$4,353,440	$4,275,997	70	98%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.010	1.148	0.005	0.042	0.268	0.081	0.005	0.190	0.002	0.002	0.002	0.616
Adopted Plan	0.001	0.007	0.009	0.008	0.012	0.010	0.009	0.009	0.009	0.012	0.010	0.023
Cum. Plan	0.001	0.009	0.018	0.026	0.038	0.047	0.056	0.065	0.074	0.096	0.096	0.119
Cum. Act	0.010	1.157	1.163	1.204	1.472	1.553	1.557	1.747	1.749	1.752	1.753	2.369

Lifetime Cash Flow



Pre-97 Act 0.000	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Dec-08											1.001	2.369
Budget												
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.001	3.369

RWSP Project Report
DECEMBER 2008

423584 West Point Odor Improvements

Project Description

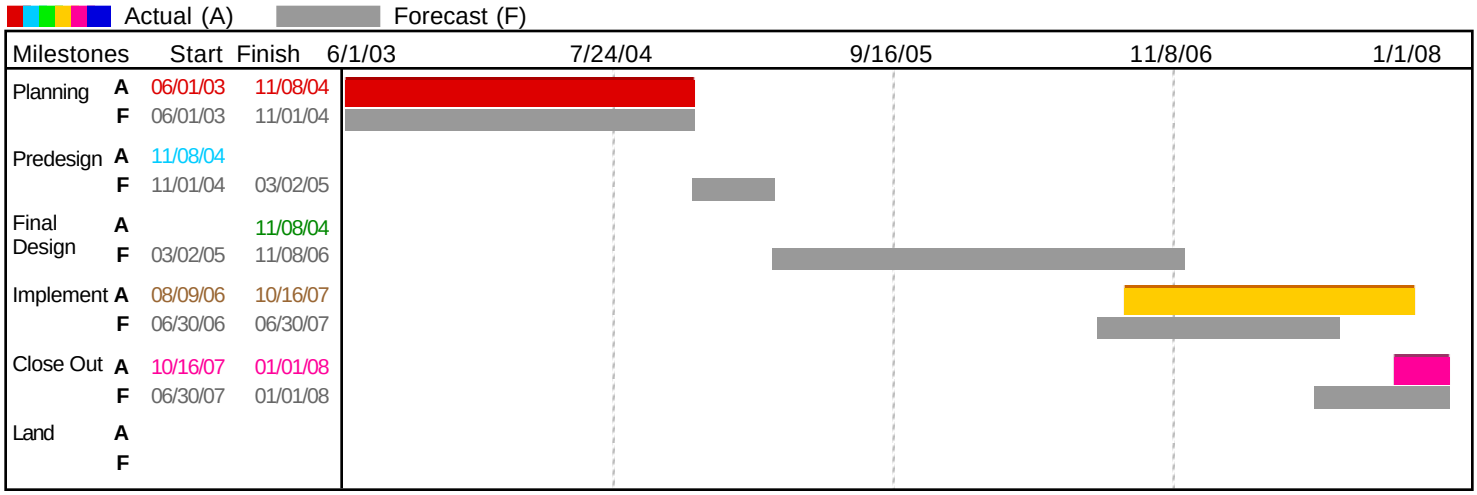
This project will reduce odor emissions by modifying the scrubber sump chemical storage, feed and regulation system to allow injection of sodium hypochlorite. The division channel has also been covered and its foul air is now treated in the scrubber system.

This project was substantially complete in 2007. Efforts in 2008 focused on evaluating these odor control improvements.

Project Phase: Complete

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	0	0	0	554,037	816,718	554,037
Construction Contracts	0	0	0	551,276	813,639	551,276
Owner Furnished Equipment	0	0	0	2,761	3,078	2,761
NON-CONSTRUCTION	4,821	0	5,000	840,115	717,790	840,294
Engineering	3,639	0	0	399,793	403,095	396,154
Planning & Management Svcs.	0			0		
Permitting & Other Agency Support	300	0	0	3,914	3,614	3,614
Right-of-Way	0	0	0	152	0	152
Misc. Services & Materials	0	0	0	23,884	21,930	23,884
Staff Labor	882	0	5,000	412,372	289,151	416,490
PROJECT RESERVE		0	0	0	25,000	0
Project Reserve		0	0	0	25,000	0
Total $	4,821	0	5,000	1,394,152	1,559,508	1,394,331

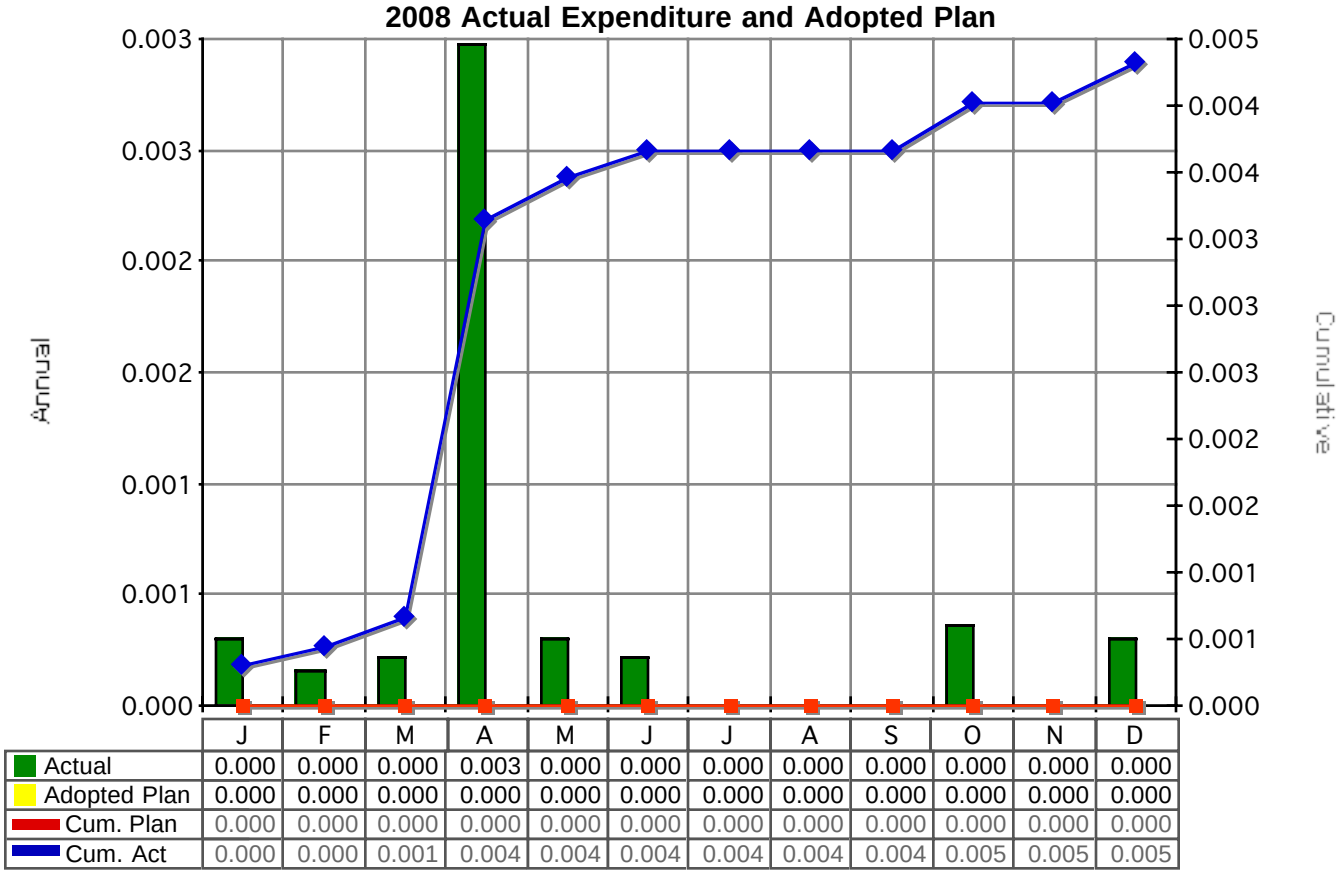
Cost/Budget Adjustments

It was determined that a structural canopy that was intended to cover the sodium hypochlorite storage tank was not necessary. Because of this, the updated lifetime budget of the project was reduced.

Contract Status

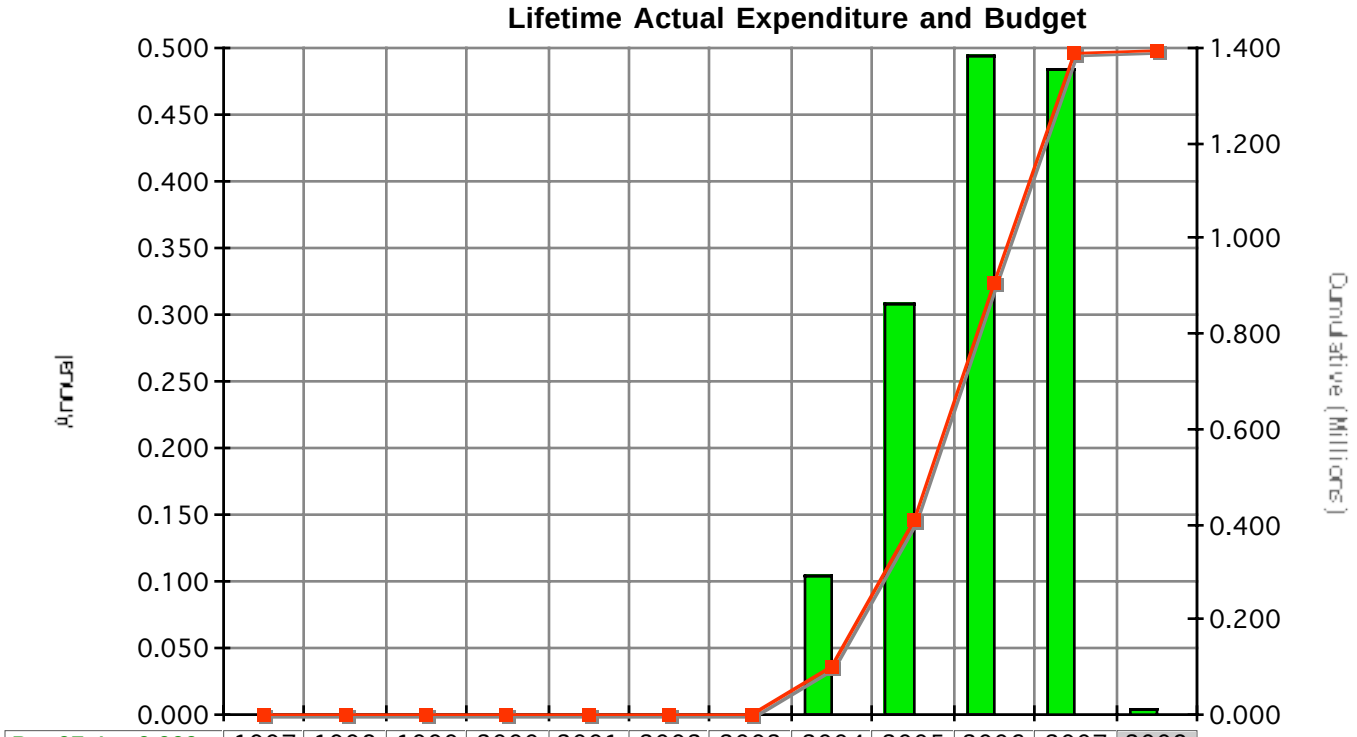
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
WPTP Odor Improvements C00024C06	$765,340	$0	$765,340	-$59,459	-8%	2	$705,881	$705,881	5	100%
West Point Odor Improvements E43012E	$73,614	$251,889	$325,503	$35,722	11%	2	$361,225	$357,087	30	99%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Adopted Plan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cum. Plan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cum. Act	0.000	0.000	0.001	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005

Lifetime Cash Flow



Pre-97 Act 0.000	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Dec-08								0.103	0.307	0.494	0.484	0.005
Budget												
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.103	0.411	0.905	1.389	1.394

RWSP Project Report
DECEMBER 2008

423585 South Plant Odor Improvements

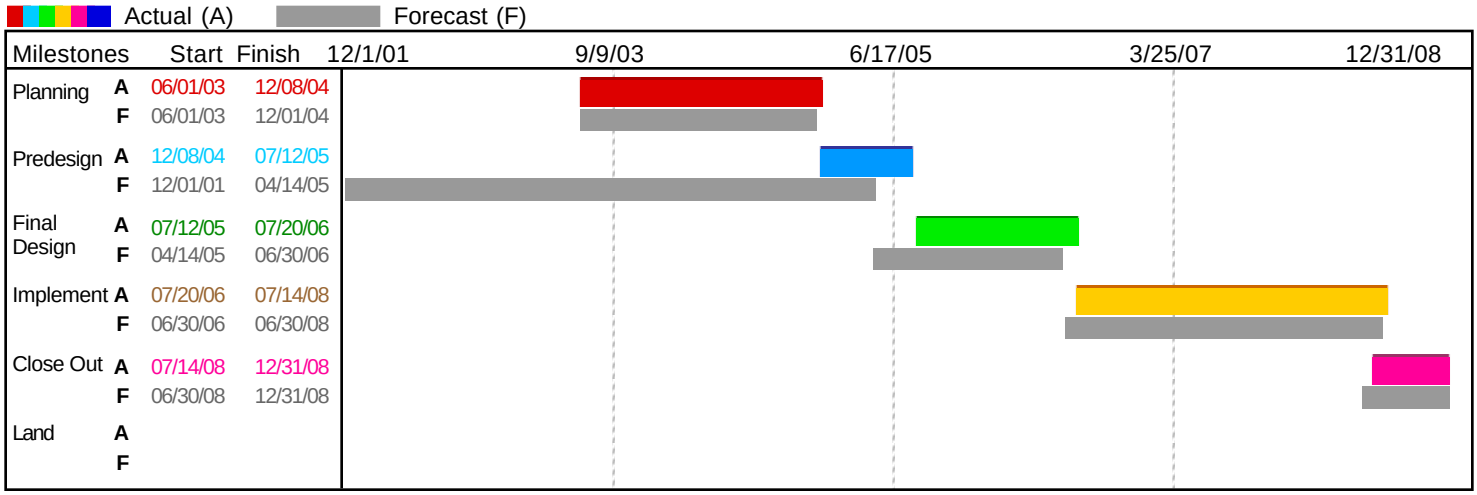
Project Description

This project installed covers on the first pass of each aeration basin and the return activated sludge channel. The foul air from those sources were ducted to a new chemical scrubber for treatment prior to discharge to the atmosphere. These improvements were substantially complete by the end of 2007; efforts in 2008 focused on evaluating these improvements.

Project Phase: Complete

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	338,077	740,933	499,600	5,881,281	5,686,097	6,042,804
Construction Contracts	338,077	740,933	499,600	5,835,255	5,640,072	5,996,778
Owner Furnished Equipment	0	0	0	46,026	46,026	46,026
NON-CONSTRUCTION	141,250	54,742	75,515	2,010,177	1,381,342	1,944,443
Engineering	24,057	0	40,000	730,806	595,360	746,749
Planning & Management Svcs.	5,119	0	0	5,741	356	622
Permitting & Other Agency Support	19	0	0	24,020	24,001	24,001
Misc. Services & Materials	12,762	0	0	181,069	144,311	168,306
Staff Labor	99,293	54,742	35,515	1,068,542	617,315	1,004,764
PROJECT RESERVE		0	0	0	16,390	0
Project Reserve		0	0	0	16,390	0
Total $	479,327	795,675	575,115	7,891,458	7,083,830	7,987,246

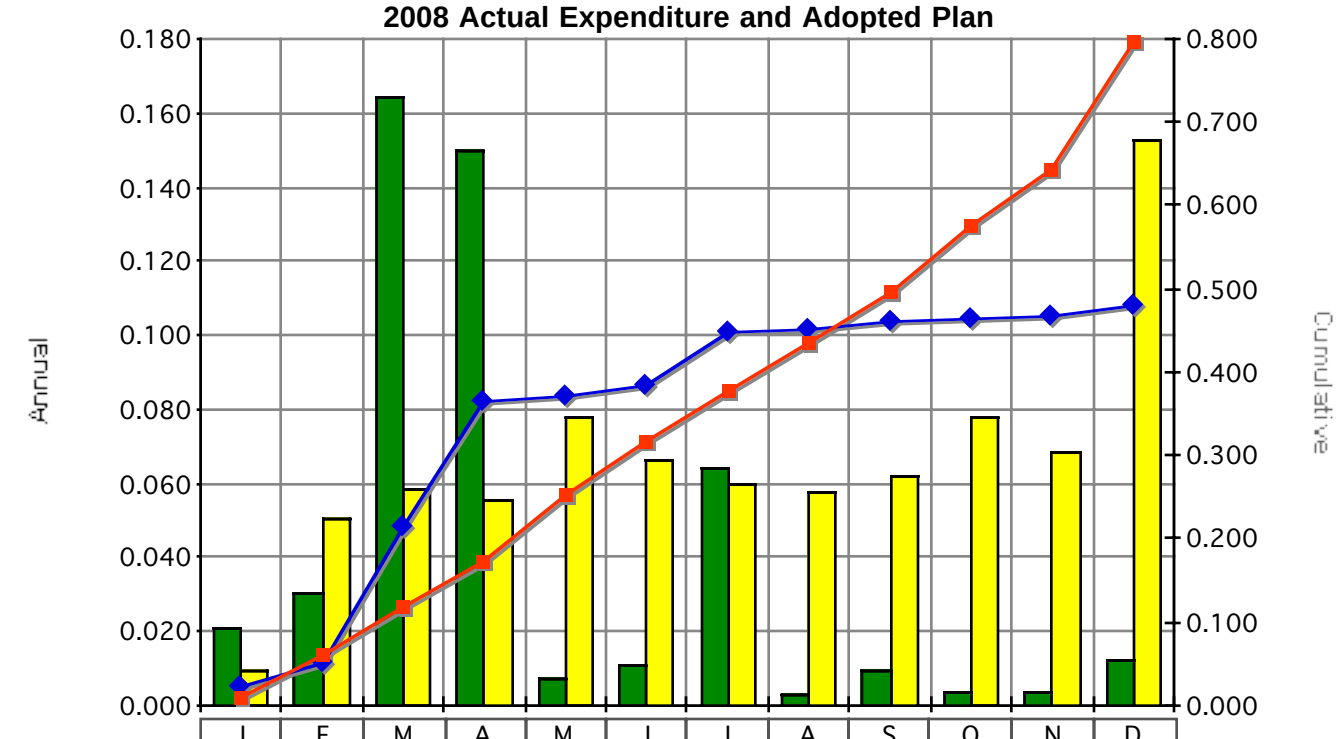
Cost/Budget Adjustments

The adjustments in the lifetime budget reflects the costs associated with the additional structural work that was required to support the aeration basin covers.

Contract Status

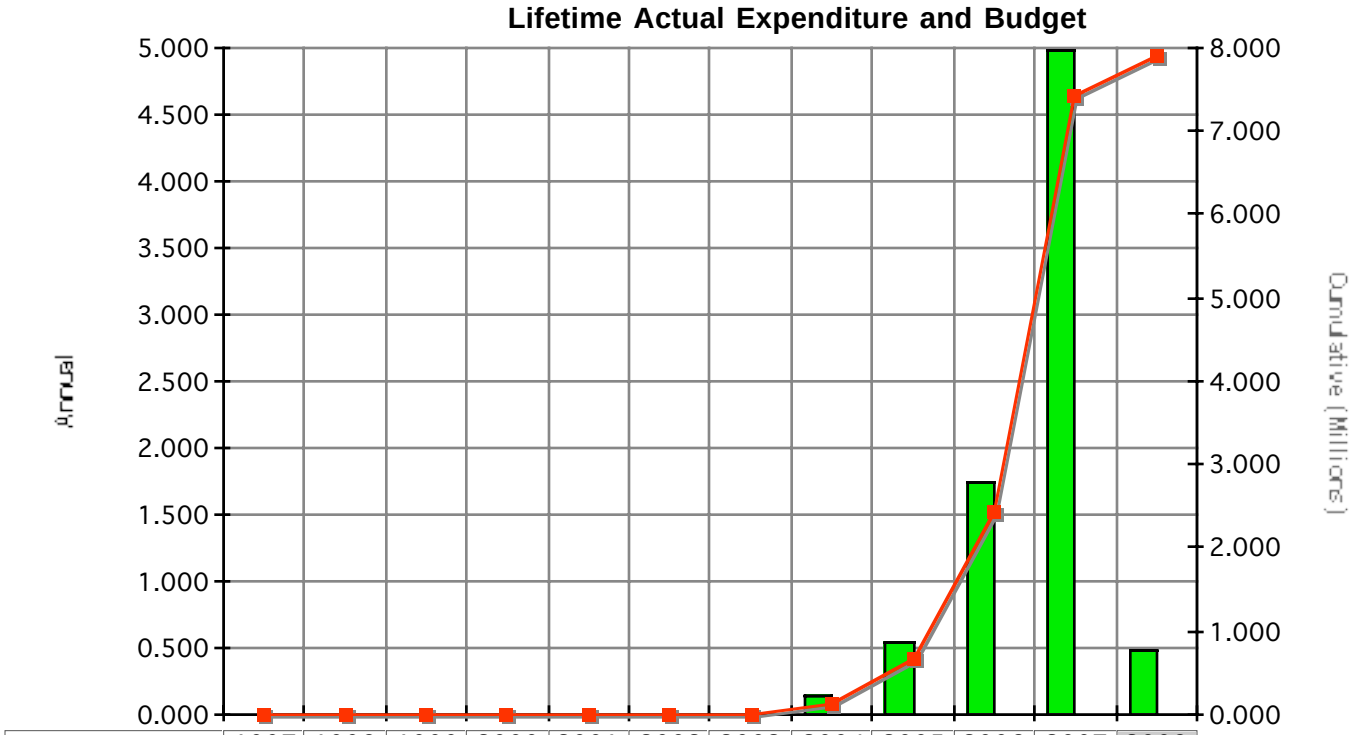
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
South Plant Odor Control Improvements C00016C06	$6,157,648	$0	$6,157,648	-$539,232	-9%	5	$5,618,416	$5,618,416	18	100%
South Plant Odor Improvements E43016E	$108,056	$330,979	$439,034	$175,491	40%	5	$614,525	$601,494	40	98%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.021	0.030	0.164	0.150	0.008	0.011	0.064	0.003	0.009	0.004	0.003	0.012
Adopted Plan	0.010	0.050	0.058	0.056	0.078	0.066	0.060	0.057	0.062	0.078	0.068	0.153
Cum. Plan	0.010	0.060	0.118	0.173	0.251	0.317	0.377	0.434	0.497	0.643	0.643	0.796
Cum. Act	0.021	0.051	0.215	0.365	0.372	0.383	0.447	0.450	0.460	0.464	0.467	0.479

Lifetime Cash Flow



Pre-97 Act 0.000	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Dec-08								0.139	0.541	1.745	4.987	0.479
Budget												
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.139	0.680	2.425	7.412	7.891

RWSP Project Report
DECEMBER 2008

423580 King Street Regulator Odor Control

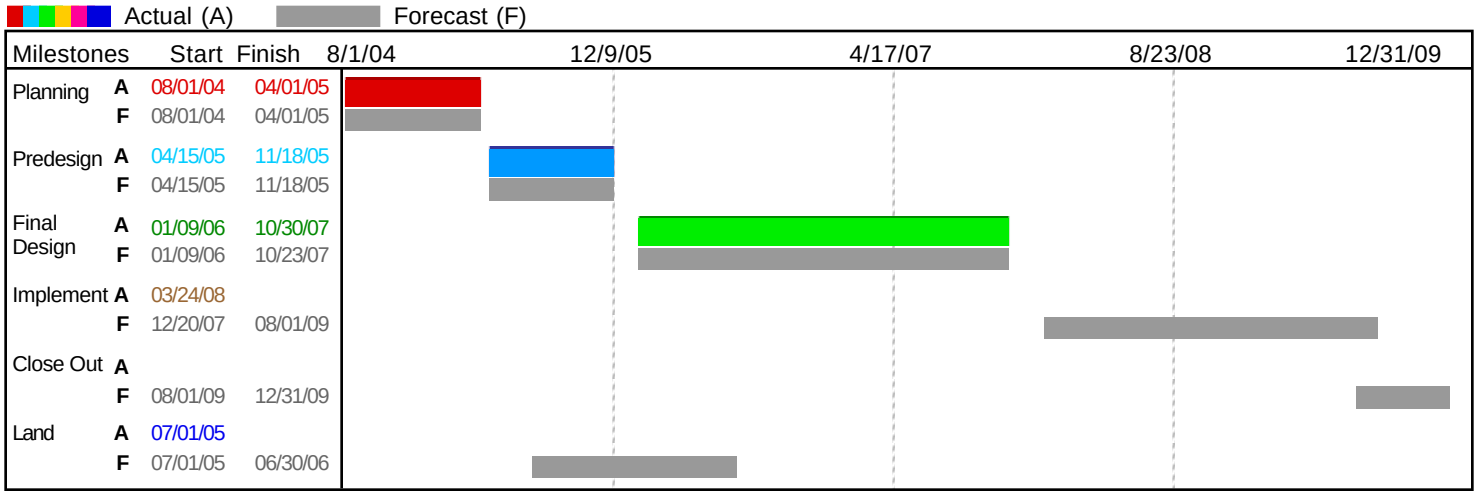
Project Description

This project will reduce foul odors emanating from the Elliott Bay Interceptor (EBI) into the south Pioneer Square and stadium areas. As this is part of the old combined sewer system, there are many open connections to the EBI, such as surface drains, that allow a direct path for odors to escape during periods of high flows or slight pressurization in the EBI. This project will also help to reduce corrosion within the EBI by removing hydrogen sulfide.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	1,902,681	2,159,296	2,481,738	1,909,256	3,522,207	3,982,921
Construction Contracts	1,902,681	2,158,747	2,481,205	1,902,681	3,518,956	3,975,812
Owner Furnished Equipment	0	0	0	3,584	0	3,584
Other Capital Charges	0	549	533	2,992	3,251	3,525
NON-CONSTRUCTION	774,188	322,703	555,282	1,805,142	1,331,516	1,719,516
Engineering	6,954	5,150	200,927	33,541	276,279	252,309
Planning & Management Svcs.	171,325	54,388	21,980	783,422	368,892	634,077
Permitting & Other Agency Support	54,631	0	0	67,882	116	13,251
Right-of-Way	2,500	0	150,000	7,936	0	155,436
Misc. Services & Materials	83,654	1,717	1,667	104,398	10,045	22,410
Staff Labor	455,123	261,448	180,708	807,963	676,184	642,033
PROJECT RESERVE		185,400	0	0	185,400	103,000
Project Reserve		185,400	0	0	185,400	103,000
Total $	2,676,869	2,667,400	3,037,021	3,714,398	5,039,123	5,805,437

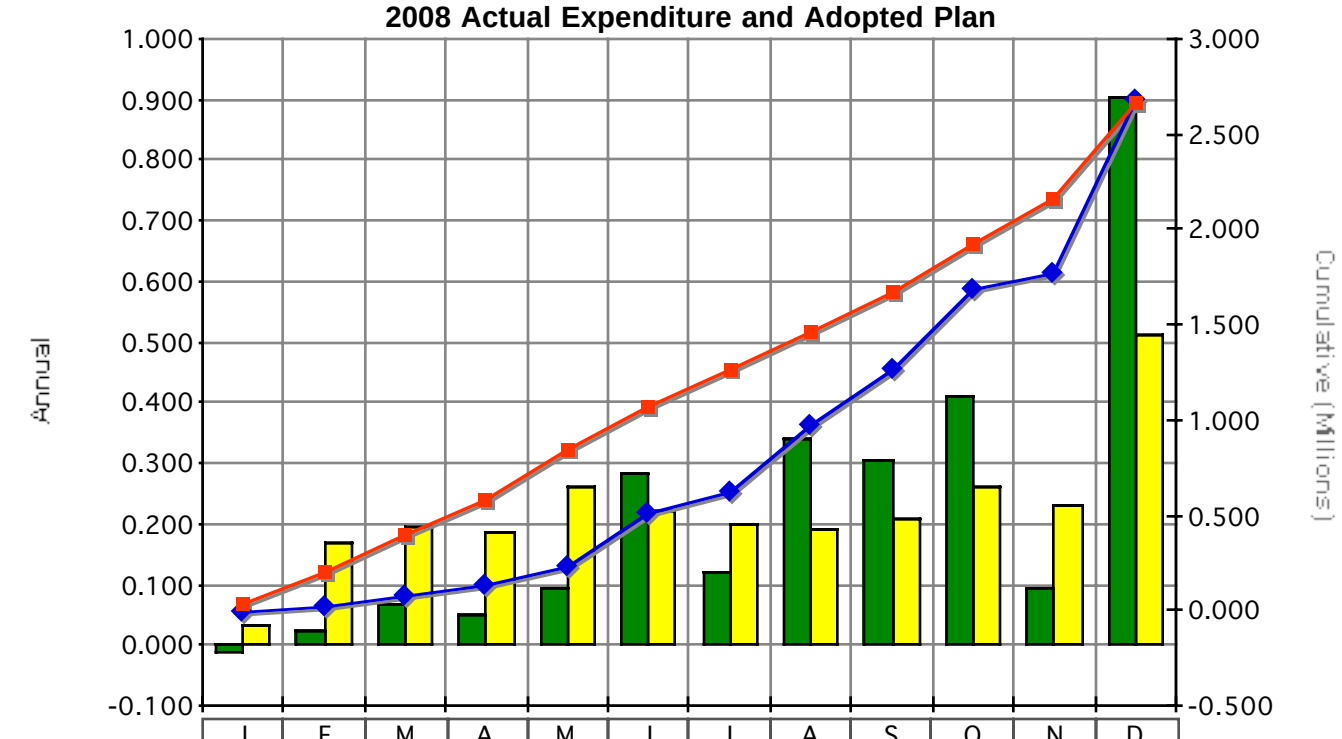
Cost/Budget Adjustments

Change in the lifetime budget estimate reflects the following project changes: structure was changed to a buried facility; need for deep pile foundation; need to dispose of contaminated on-site soils and groundwater; and design of above-grade security enclosure to house electrical switch gear.

Contract Status

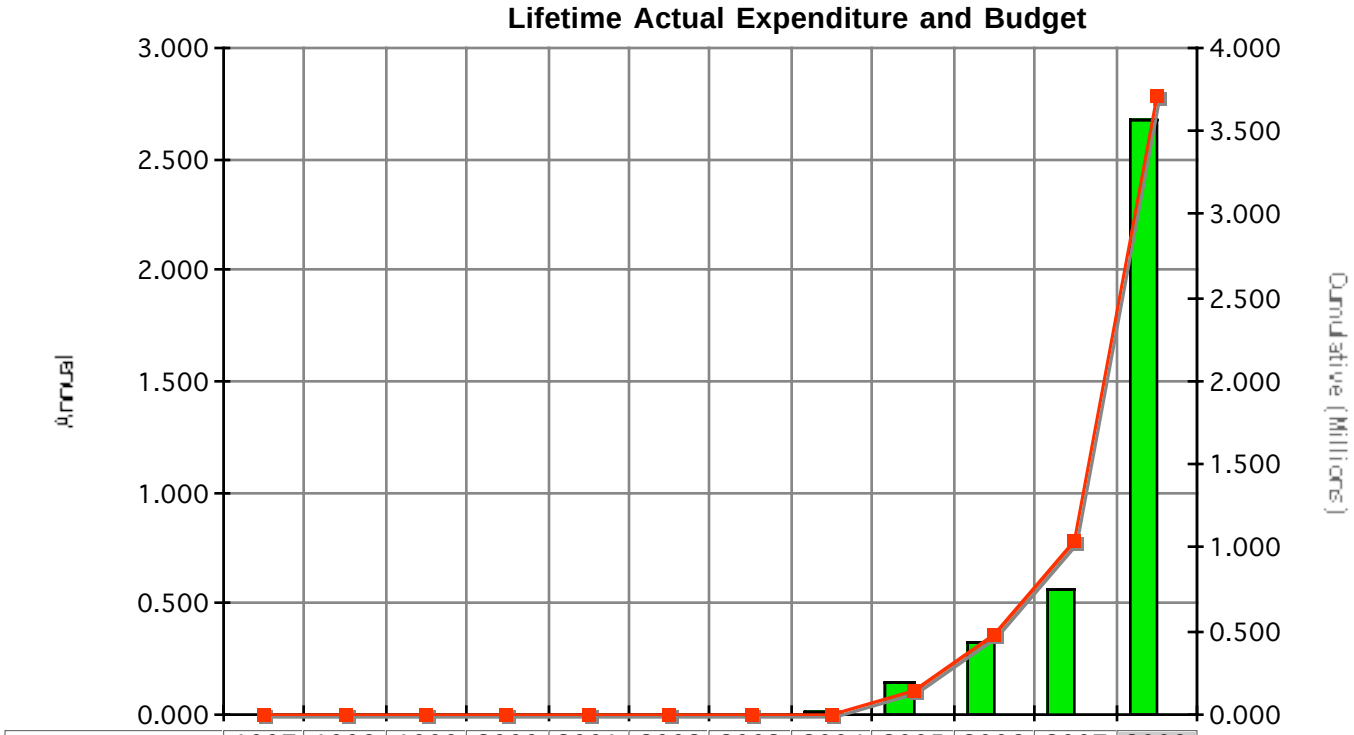
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
King Street Regulator Station and Conveyance System Odor E43024E	$368,892	$0	$368,892	$444,786	121%	6	$813,678	$620,532	25	76%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.010	0.023	0.067	0.048	0.093	0.282	0.121	0.341	0.305	0.410	0.092	0.905
Adopted Plan	0.032	0.168	0.195	0.187	0.261	0.221	0.200	0.192	0.208	0.261	0.229	0.512
Cum. Plan	0.032	0.200	0.395	0.581	0.843	1.064	1.264	1.456	1.664	2.155	2.155	2.667
Cum. Act	-0.010	0.012	0.080	0.128	0.221	0.503	0.624	0.965	1.270	1.680	1.772	2.677

Lifetime Cash Flow



Pre-97 Act 0.000	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Actual Dec-08								0.007	0.144	0.324	0.563	2.677
Budget												
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.150	0.475	1.038	3.714

RWSP Project Report
DECEMBER 2008

423521 Bellevue Pump Station

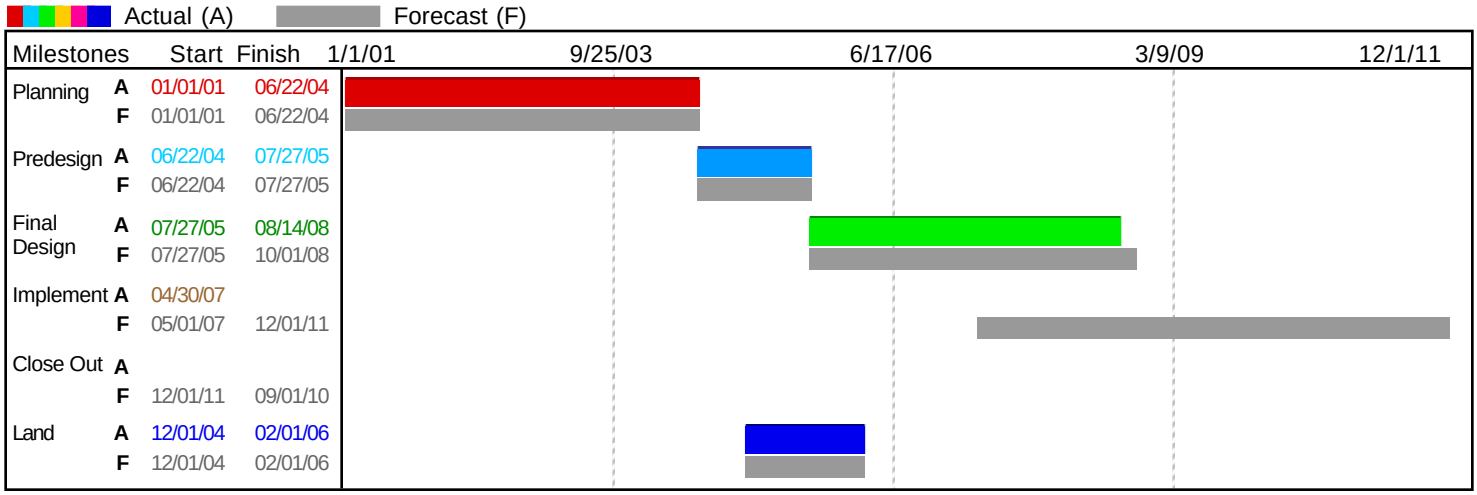
Project Description

This project will increase the Bellevue Pump Station's firm capacity to 11 million gallons per day and will improve the station's electrical and control systems. This work will be implemented through two construction contracts (Force Main and Pump Station) with all the design work performed under one consultant design contract. Under the force main contract, 5,300 feet of pipe will be installed. For a major portion of the pipe installation, a Horizontal Direction Drill method will be used. A small portion of the pipe will be installed in an open trench. Under the pump station contract, the existing pump station will be expanded and some demolition will occur. All the expansion will occur on King County property. As part of the project, existing equipment, including pumps, generator, electrical system, controls, odor control and chemical storage will be replaced.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	1,702,888	9,247,853	911,485	15,854,326	22,573,050	25,336,667
Construction Contracts	1,702,888	9,174,723	875,985	15,854,326	22,499,920	25,264,602
Outside Agency Construction		73,130	35,500	0	73,130	72,065
NON-CONSTRUCTION	1,048,538	1,352,086	375,181	7,341,217	8,259,243	8,374,739
Engineering	-58,852	549,500	40,750	4,524,208	5,262,946	5,223,810
Planning & Management Svcs.	302,268	315,867	69,667	351,566	783,517	385,964
Permitting & Other Agency Support	29,248	17,167	25,067	143,701	135,195	196,838
Right-of-Way	0	0	0	58,281	37,850	58,281
Misc. Services & Materials	121,963	36,050	28,692	243,934	132,078	171,262
Staff Labor	653,910	433,503	211,005	2,019,528	1,907,658	2,338,583
PROJECT RESERVE		0	0	0	725,125	752,889
Project Reserve		0	0	0	725,125	752,889
Total $	2,751,426	10,599,939	1,286,665	23,195,543	31,557,418	34,464,294

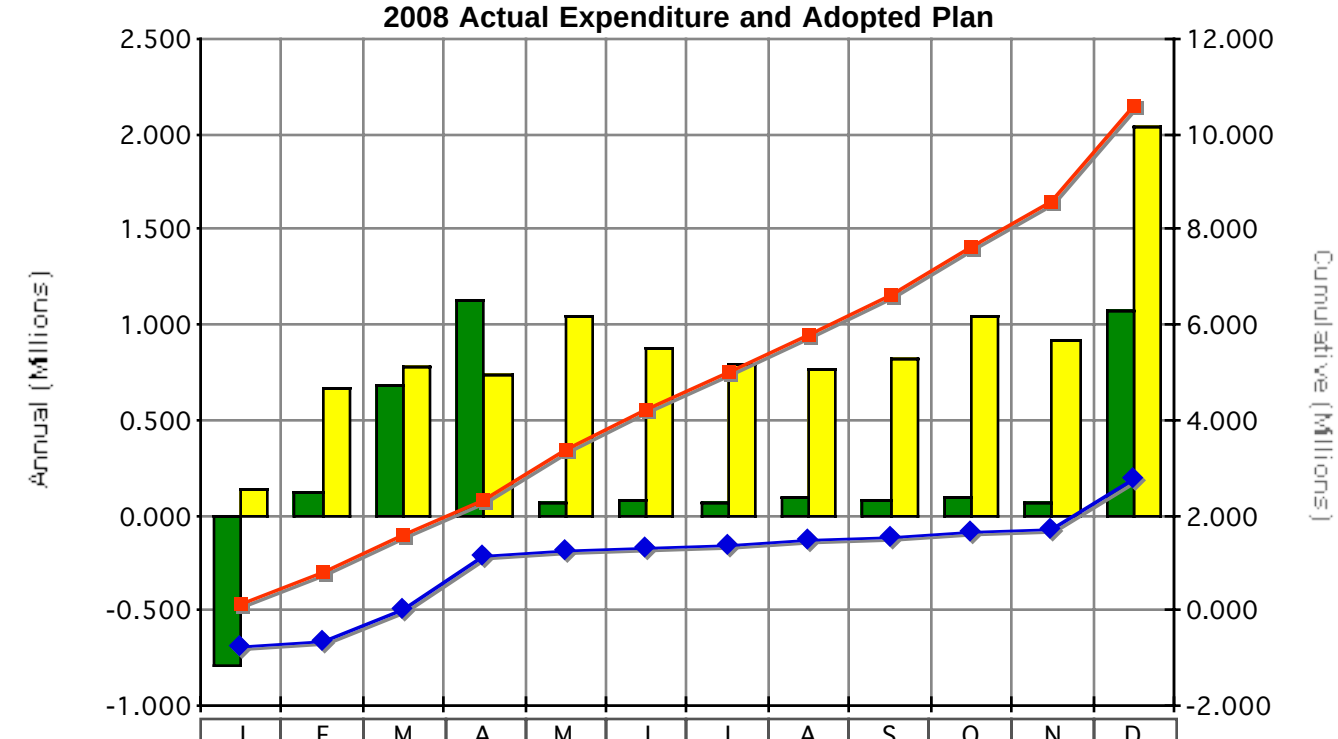
Cost/Budget Adjustments

The change in lifetime budget reflects updated construction costs based on the actual bid amount for the Belleuve Pump Station project; the earlier budget was prepared prior to receiving bids and awarding the contract and notice to proceed.

Contract Status

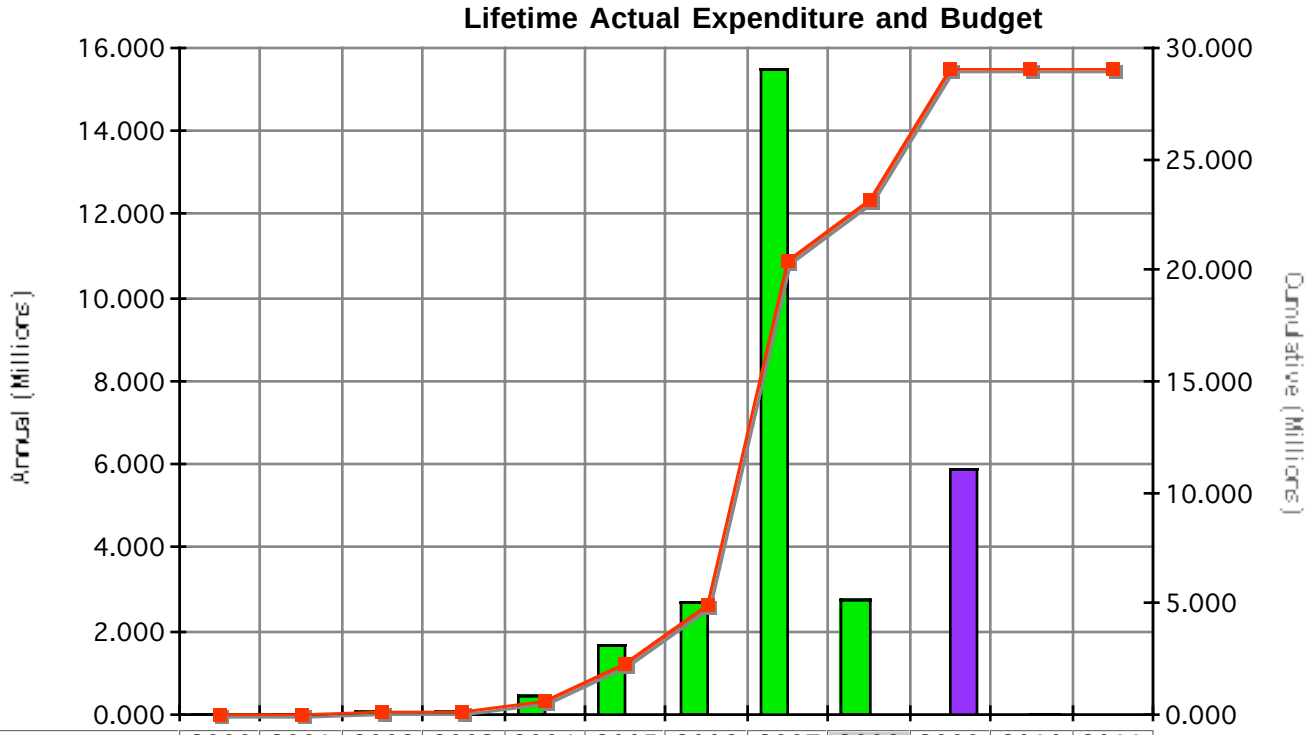
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Bellevue Pump Station Upgrade- Force Main C00044C06	$13,883,125	$0	$13,883,125	$0	0%	1	$13,883,125	$13,883,125	7	100%
Bellevue Pump Station Upgrade- Pump Station C00334C08	$8,605,000	$0	$8,605,000	$0	0%		$8,605,000	$759,502	2	9%
Engineering Services for the Bellevue Pump Station E23015E	$775,015	$5,066,666	$5,841,681	$0	0%	8	$5,841,681	$4,333,832	66	74%
Construction management service for Bellevue Pump P00016P06	$298,445	$0	$298,445	$0	0%	1	$298,445	$34,183	3	11%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.784	0.127	0.684	1.133	0.067	0.072	0.059	0.095	0.073	0.088	0.068	1.071
Adopted Plan	0.127	0.668	0.774	0.742	1.039	0.880	0.795	0.763	0.827	1.039	0.912	2.035
Cum. Plan	0.127	0.795	1.569	2.311	3.350	4.229	5.024	5.788	6.614	8.565	8.565	10.60
Cum. Act	-0.784	-0.657	0.026	1.159	1.226	1.298	1.356	1.451	1.524	1.613	1.681	2.751

Lifetime Cash Flow



	Pre-2000 Act 0.000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Actual Dec-08		0.006	0.014	0.068	0.072	0.472	1.656	2.658	15.49	2.751			
Budget											5.856	0.018	0.000
CumAct+Bdgt		0.006	0.021	0.088	0.161	0.632	2.288	4.946	20.44	23.19	29.05	29.07	29.07

RWSP Project Report
DECEMBER 2008

423615 Black Diamond Storage Facility

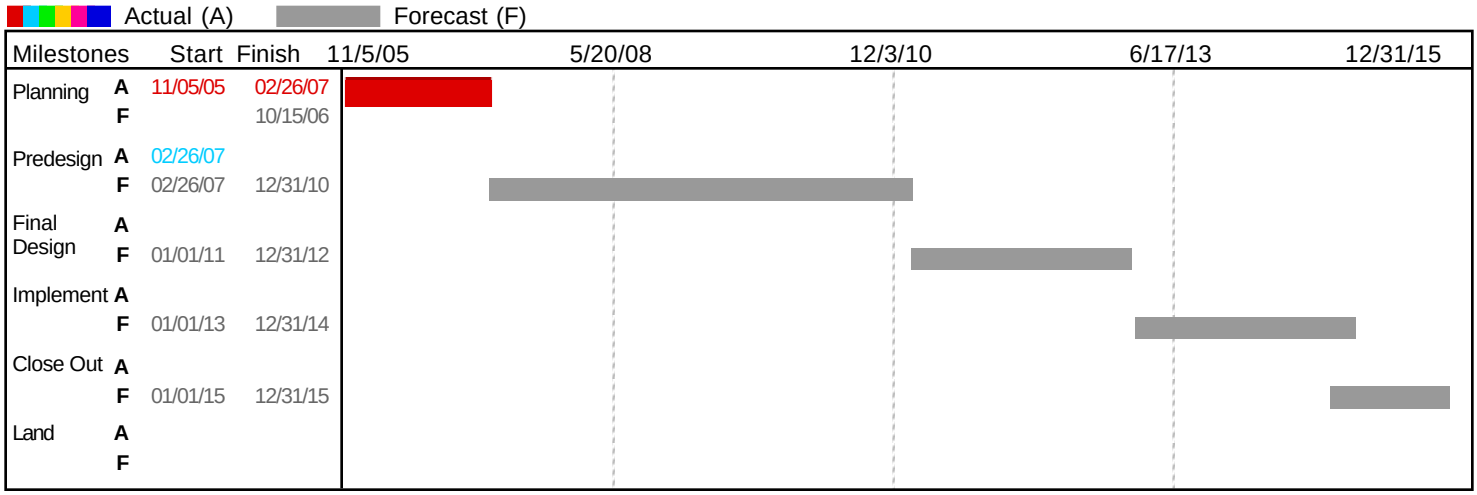
Project Description

This project includes building an enclosed peak-flow equalization storage facility in the City of Black Diamond. The facility will store peak flows entering the pump station in Black Diamond and release them slowly over time to avoid overwhelming the downstream conveyance system. It will extend the life of existing equipment and defer the need to build additional new pumping and conveyance facilities for several years. Based on current master planned development planning, the facility is anticipated to be online by 2015.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The schedule is delayed to support Black Diamond's updated projected population growth estimates.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION		0	0	0	2,634,745	8,352,252
Construction Contracts		0	0	0	2,422,565	8,134,421
Outside Agency Construction		0	0	0	212,180	217,830
NON-CONSTRUCTION	449,785	1,050,230	829,701	449,785	1,428,396	2,807,206
Engineering	123,871	330,000	657,752	123,871	380,000	1,427,795
Planning & Management Svcs.	101,452	22,660	27,202	101,452	22,660	27,202
Permitting & Other Agency Support		103,000	0	0	103,000	103,000
Right-of-Way		412,000	40,000	0	412,000	722,144
Misc. Services & Materials	12,897	13,390	13,000	12,897	27,182	25,036
Staff Labor	211,566	169,180	91,746	211,566	483,554	502,030
PROJECT RESERVE		0	0	0	573,682	1,601,100
Project Reserve		0	0	0	573,682	1,601,100
Total $	449,785	1,050,230	829,701	449,785	4,636,822	12,760,558

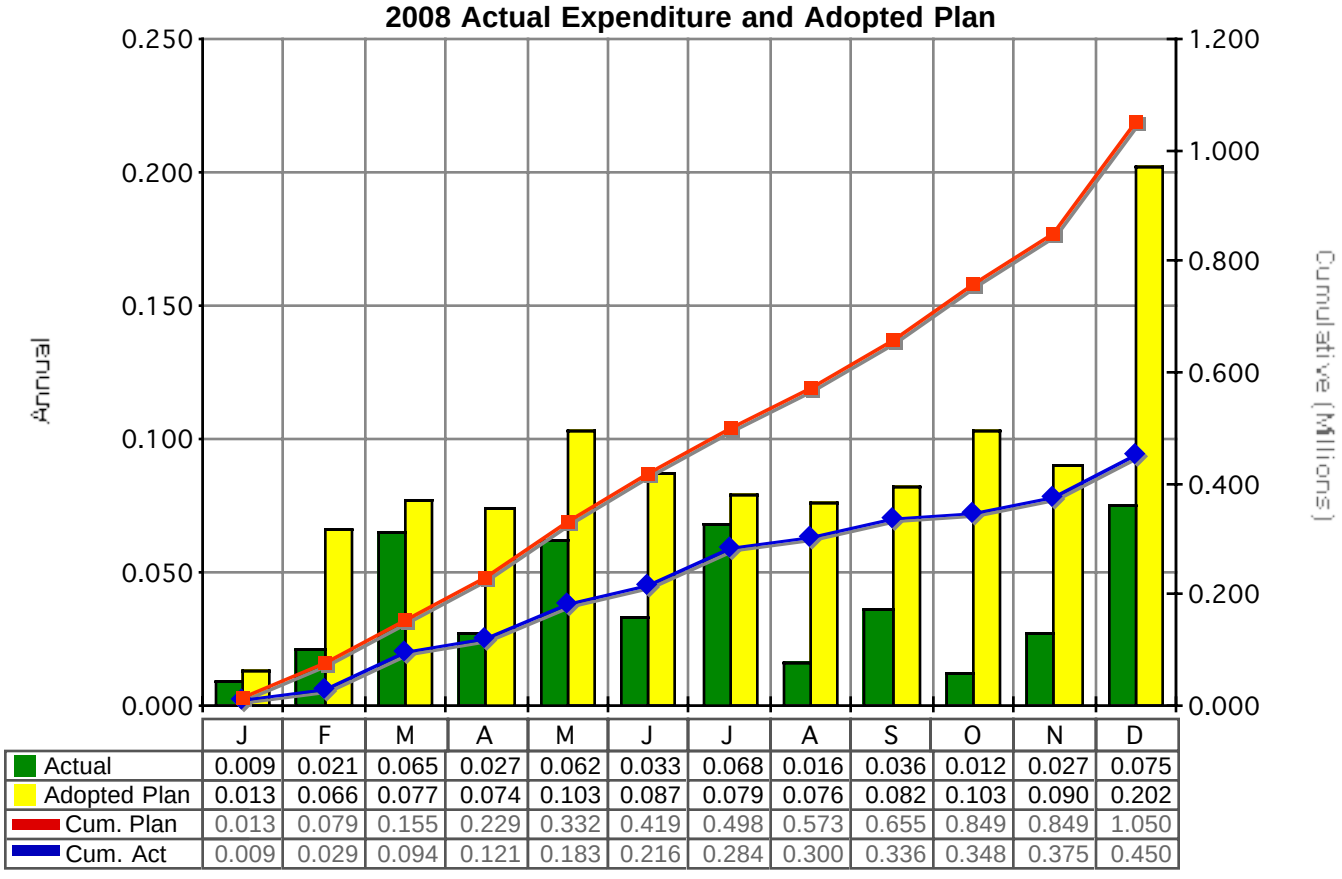
Cost/Budget Adjustments

The change in lifetime budget reflects a more detailed and updated cost estimate developed by the consultant. The original lifetime budget cost estimate was developed in 2005 through the use of Tabula, the Wastewater Treatment Division's planning-level estimating software.

Contract Status

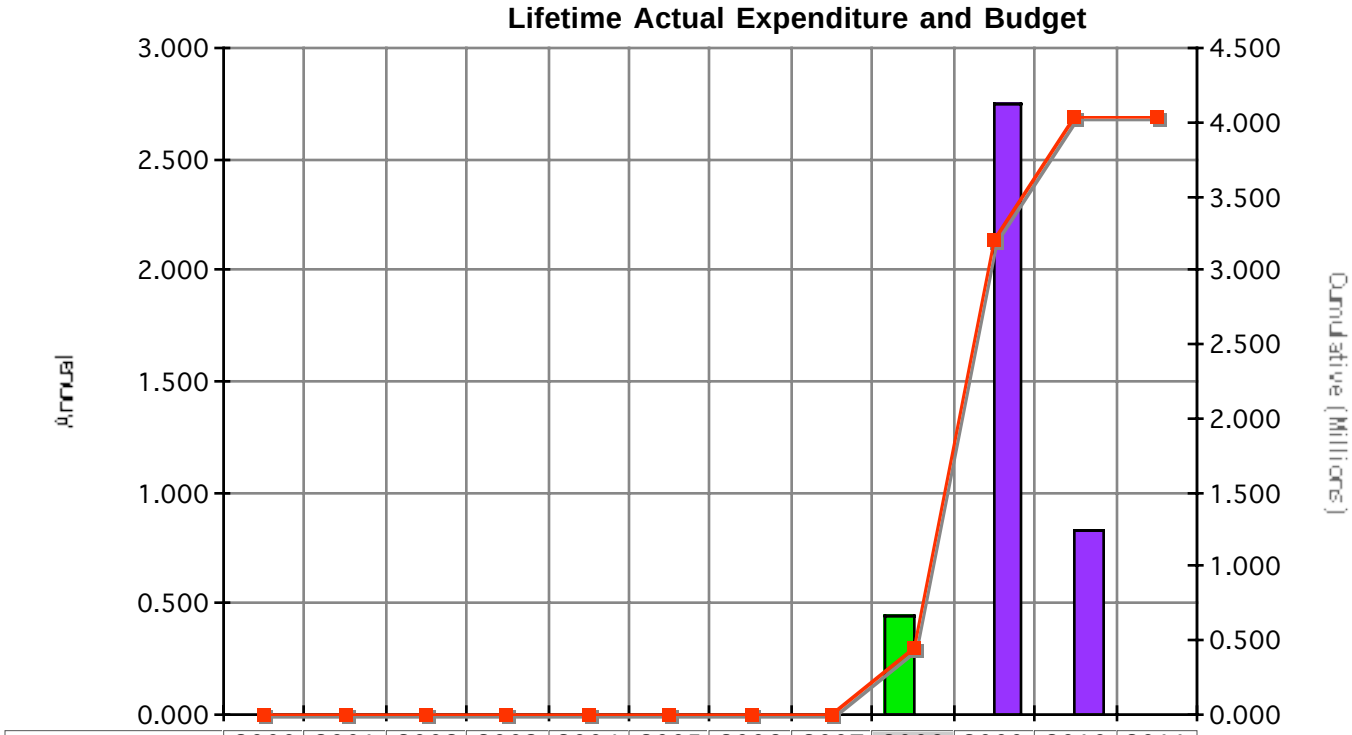
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Black Diamond Storage Facility E00003E06	$617,610	$0	$617,610	$301,239	49%	2	$918,849	$447,335	18	49%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.009	0.021	0.065	0.027	0.062	0.033	0.068	0.016	0.036	0.012	0.027	0.075
Adopted Plan	0.013	0.066	0.077	0.074	0.103	0.087	0.079	0.076	0.082	0.103	0.090	0.202
Cum. Plan	0.013	0.079	0.155	0.229	0.332	0.419	0.498	0.573	0.655	0.849	0.849	1.050
Cum. Act	0.009	0.029	0.094	0.121	0.183	0.216	0.284	0.300	0.336	0.348	0.375	0.450

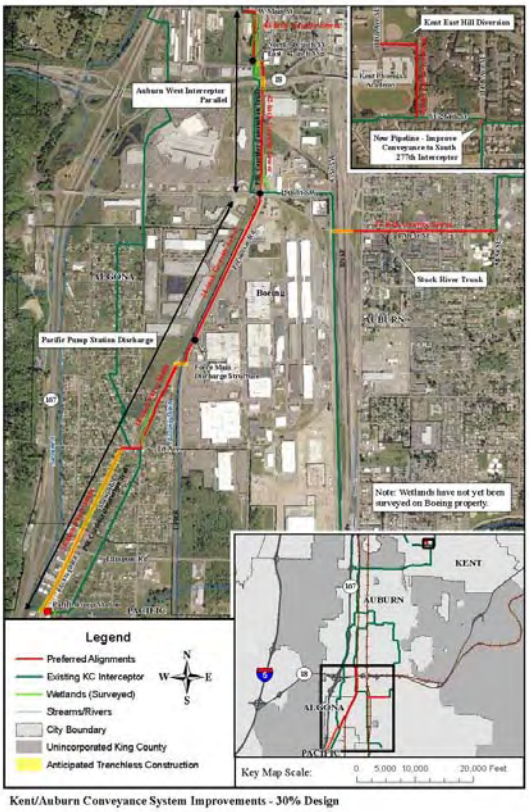
Lifetime Cash Flow



	Pre-2000 Act 0.000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Actual Dec-08										0.450			
Budget											2.753	0.834	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.450	3.203	4.036	4.036

RWSP Project Report
DECEMBER 2008

423582 SW Interceptor (2004-03)



Kent/Auburn Conveyance System Improvements - 30% Design

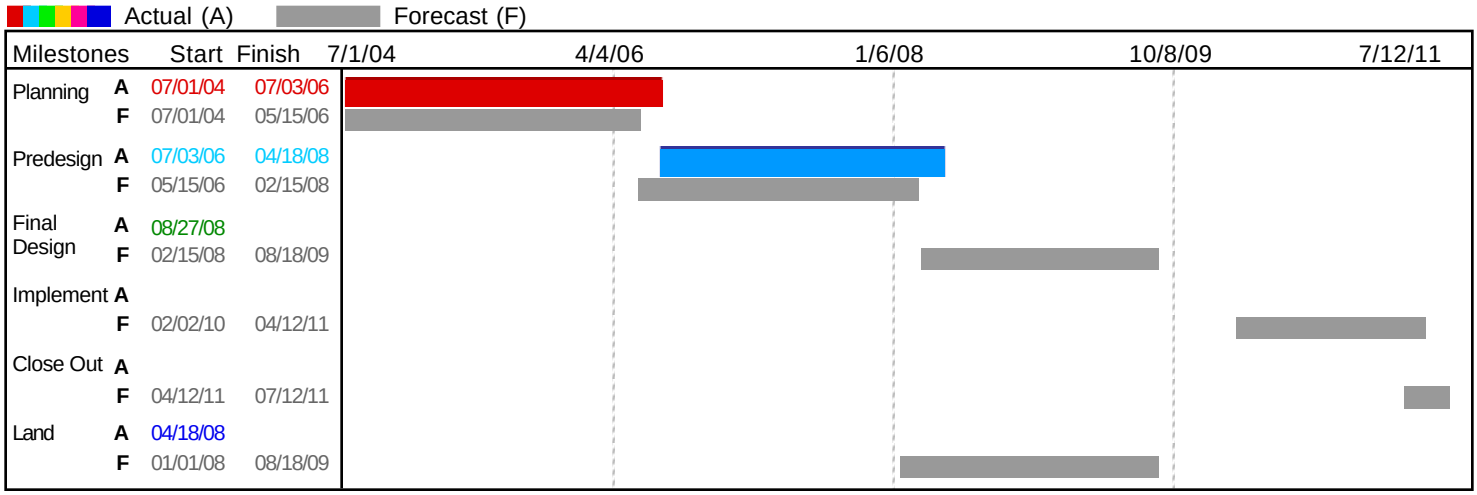
Project Description

This project will construct approximately 3 miles of new sewer in Auburn, Kent, Algona, and Pacific. The project consists of four individual projects that will be built in two phases: Phase A and Phase B. Phase A projects (the Stuck River Trunk and Kent East Diversion Hill) are expected to be in service in 2011. The Stuck River Trunk includes approximately 3,900 feet of new 27-inch-diameter gravity sewer pipe to divert flows upstream of the M Street Trunk to the Lakeland Hills Trunk. The Kent East Hill Diversion includes 1,800 feet of new 24-inch-diameter gravity sewer pipe to divert flows from the Mill Creek Interceptor to the South 277th Street Interceptor.

Phase B projects include the Pacific Pump Station Discharge and the Auburn West Interceptor Parallel in Auburn. The Pacific Pump Station Discharge includes approximately 7,900 feet of new pipe to carry flow north from the Pacific Pump Station to the Auburn West Interceptor. The Auburn West Interceptor Parallel includes approximately 2,600 feet of new gravity pipe to parallel an existing portion of the Auburn West Interceptor.

Project Phase: 3 Final Design

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	0	0	0	5,294	32,110,149	8,087,638
Construction Contracts		0	0	0	32,021,143	7,993,338
Other Capital Charges	0	0	0	5,294	89,006	94,300
NON-CONSTRUCTION	1,396,249	4,336,410	2,230,919	3,857,059	12,058,803	8,071,228
Engineering	1,014,910	2,143,214	1,275,750	2,737,134	5,710,081	3,747,974
Planning & Management Svcs.	-57,000	103,000	10,300	4,000	1,488,321	728,083
Permitting & Other Agency Support	1,944	272,950	272,950	6,382	282,950	277,388
Right-of-Way		1,060,900	0	0	1,060,900	491,727
Misc. Services & Materials	47,913	117,935	117,935	91,844	561,300	561,364
Staff Labor	388,481	638,410	553,984	1,017,699	2,955,251	2,264,693
PROJECT RESERVE		0	0	0	1,802,999	0
Project Reserve		0	0	0	1,802,999	0
Total $	1,396,249	4,336,410	2,230,919	3,862,353	45,971,951	16,158,867

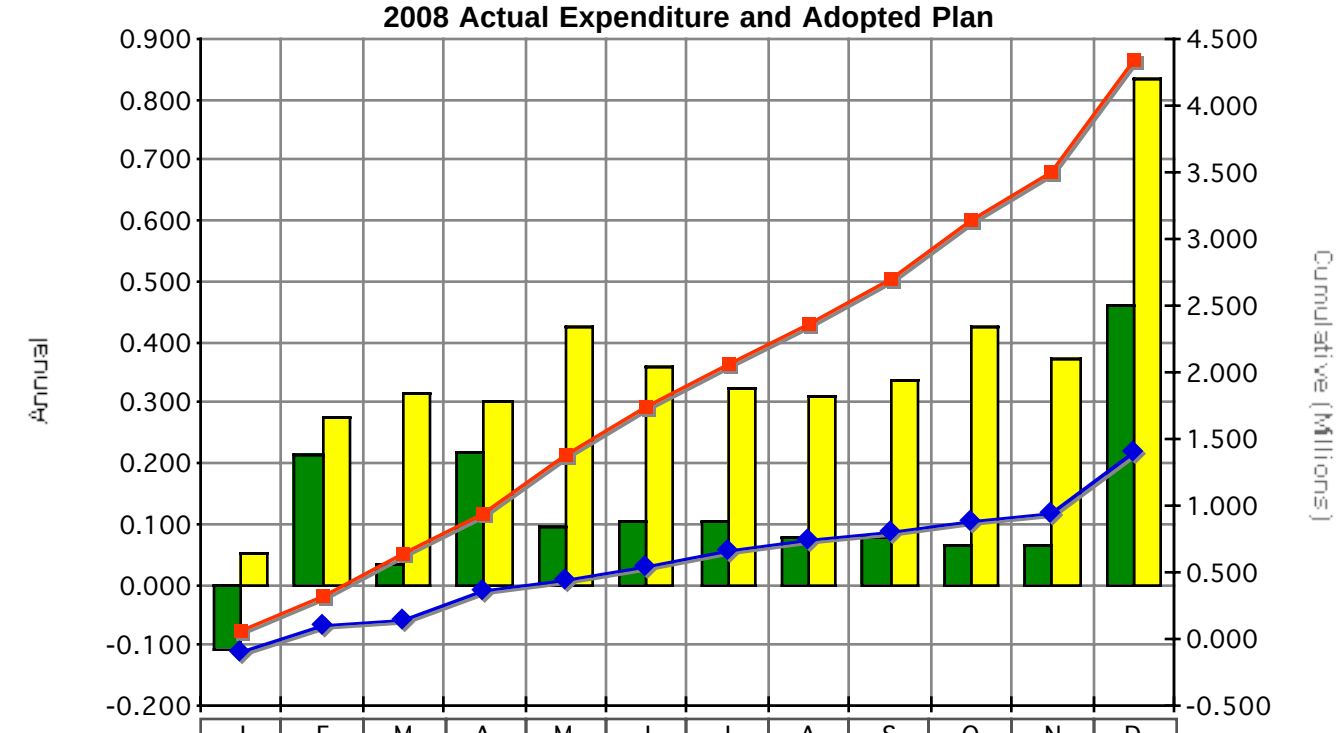
Cost/Budget Adjustments

Lifetime budget has changed because the project scope was reduced. The project lifetime budget reflects completion of Phase A work, property acquisition, and 60 percent design of Phase B work. Completion of design and construction of Phase B work are included in a future project number (2009-018).

Contract Status

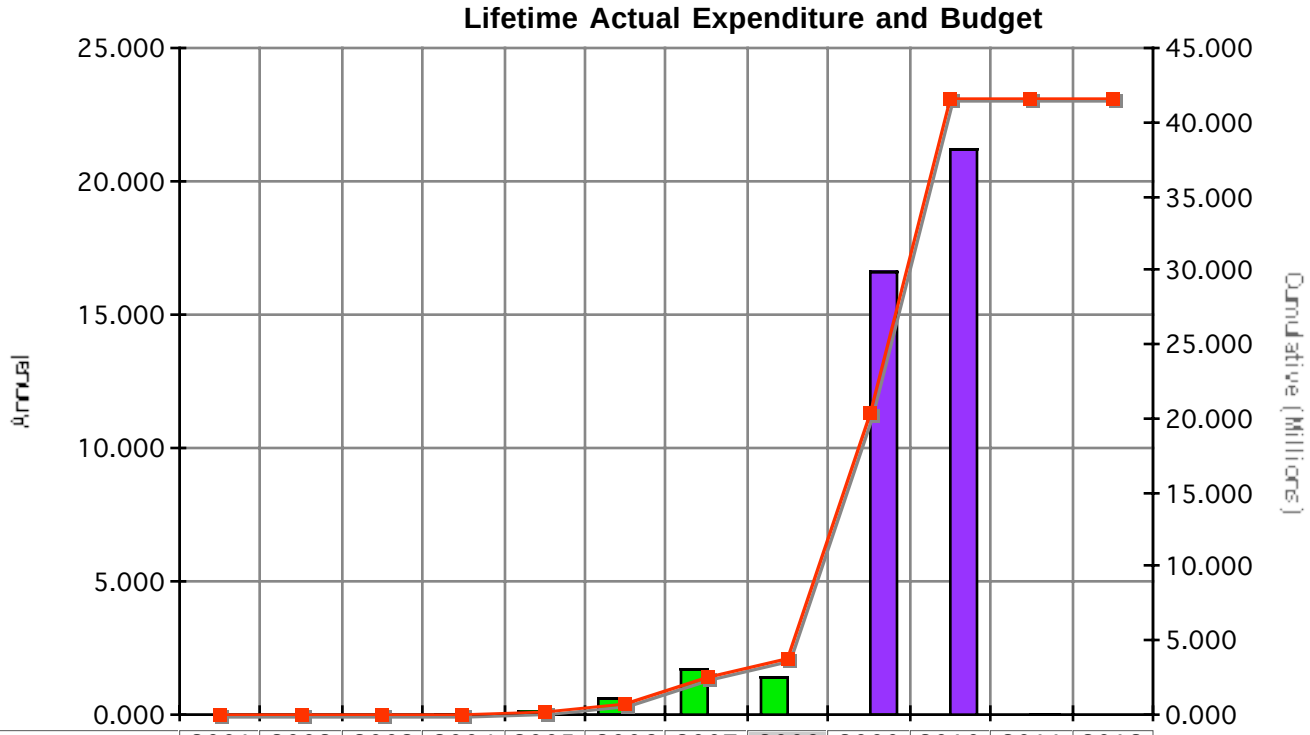
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Engineering Services for Kent Auburn Conveyance System E53009E	$2,686,967	$2,107,416	$4,794,383	$484,965	10%	2	$5,279,347	$2,293,834	25	43%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.109	0.212	0.032	0.218	0.094	0.102	0.105	0.077	0.075	0.064	0.065	0.461
Adopted Plan	0.052	0.273	0.317	0.304	0.425	0.360	0.325	0.312	0.338	0.425	0.373	0.833
Cum. Plan	0.052	0.325	0.642	0.945	1.370	1.730	2.055	2.368	2.706	3.504	3.504	4.336
Cum. Act	-0.109	0.103	0.135	0.353	0.446	0.549	0.654	0.731	0.806	0.870	0.935	1.396

Lifetime Cash Flow



Pre-01 Act 0.000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Actual Dec-08				0.015	0.087	0.643	1.721	1.396				
Budget									16.56	21.20	0.028	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.015	0.102	0.745	2.466	3.862	20.42	41.63	41.66	41.66

RWSP Project Report
DECEMBER 2008

423365 Hidden Lake PS/Boeing Creek Trunk

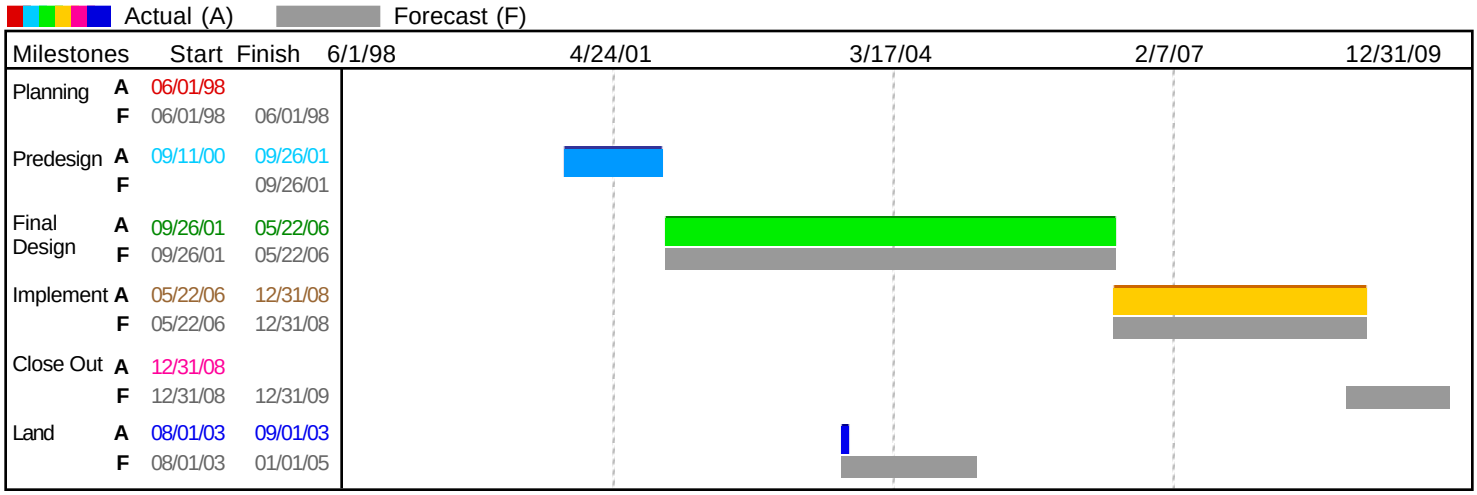
Project Description

This project included constructing a new Hidden Lake Pump Station, approximately 12,000 feet of new sewer pipeline, and a 500,000-gallon underground storage pipe. The project is located in the City of Shoreline. Construction started in May 2006 and was completed in 2008.
Construction closeout is expected to be complete in early 2009.

Project Phase: 5 Closeout

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

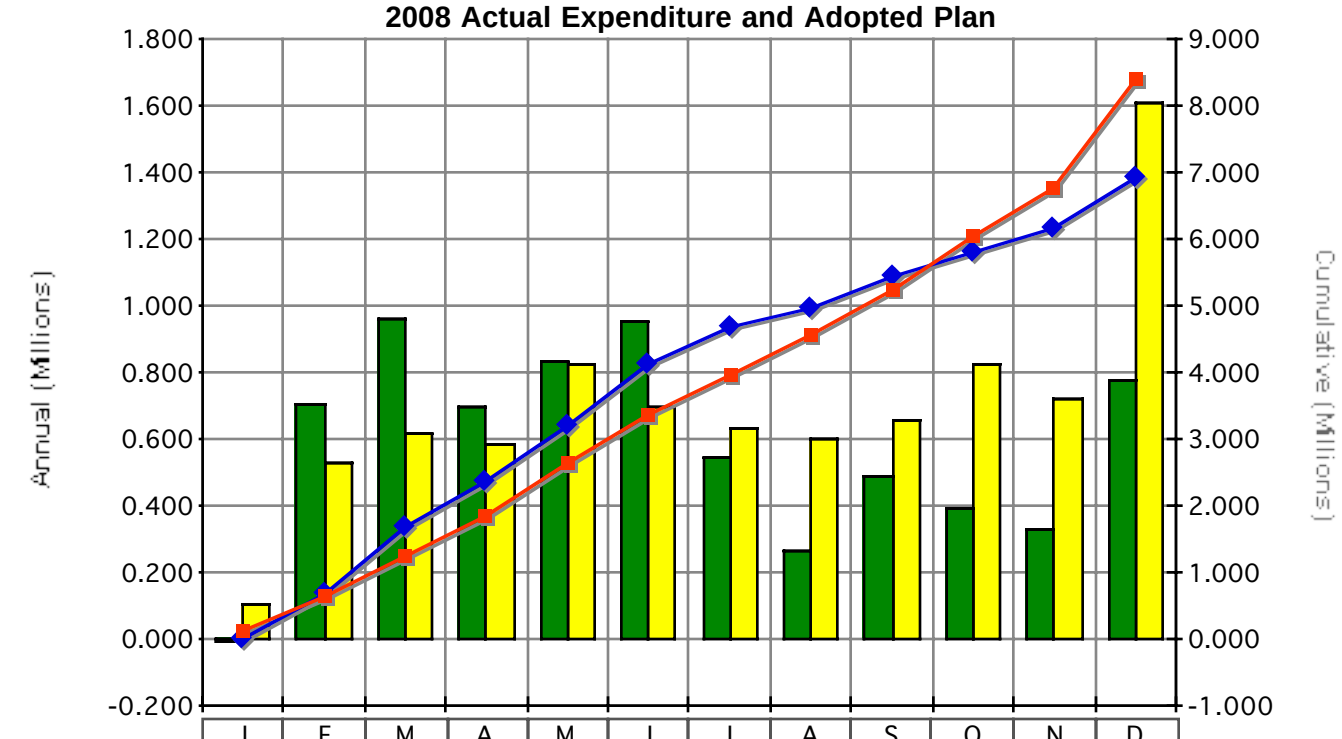
Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	5,181,926	6,855,577	6,240,795	24,079,694	26,612,848	26,112,633
Construction Contracts	5,122,923	6,477,935	5,780,154	23,973,012	25,738,339	25,604,314
Owner Furnished Equipment	79		0	568		490
Outside Agency Construction		377,642	460,641	0	861,999	460,641
Other Capital Charges	58,925	0	0	106,114	12,510	47,189
NON-CONSTRUCTION	1,742,974	1,748,850	2,277,326	11,873,492	12,016,804	12,577,150
Engineering	275,131	327,147	538,041	4,786,339	4,996,517	5,049,249
Planning & Management Svcs.	388,883	575,231	844,848	1,191,417	1,690,859	1,647,383
Permitting & Other Agency Support	25,401	15,535	39,267	1,304,563	1,302,019	1,318,429
Right-of-Way	42,691	33,774	32,790	259,699	216,196	249,798
Misc. Services & Materials	97,324	71,842	69,750	449,701	382,389	422,127
Staff Labor	913,544	725,321	752,630	3,881,772	3,428,823	3,890,164
PROJECT RESERVE		0	29,127	0	268,342	125,752
Project Reserve		0	29,127	0	268,342	125,752
CREDITS AND REVENUES		-220,052	-337,590	0	-433,694	-337,590
Credits and Revenues		-220,052	-337,590	0	-433,694	-337,590
Total $	6,924,900	8,384,375	8,209,658	35,953,185	38,464,299	38,477,946

Cost/Budget Adjustments

Contract Status

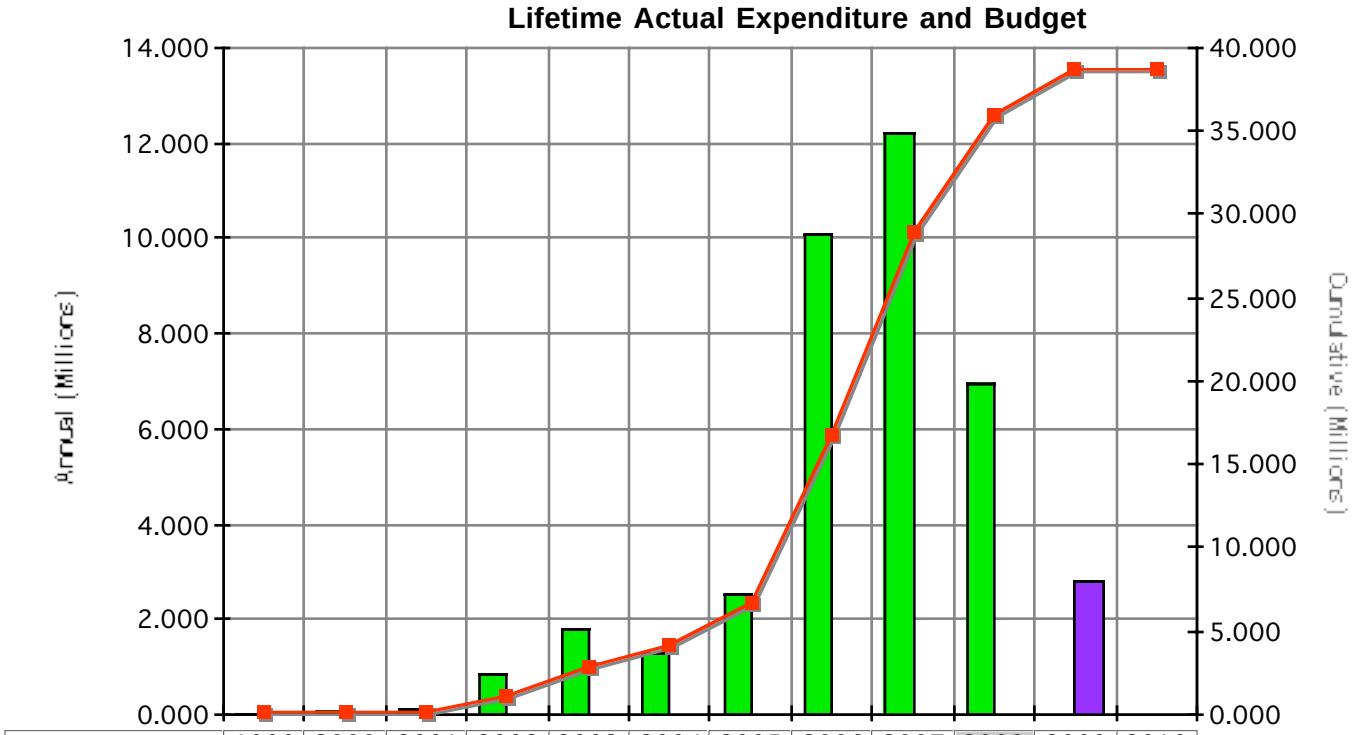
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Hidden Lake Project C53108C	$20,929,000	$0	$20,929,000	$863,039	4%	8	$21,792,039	$16,297,043	17	75%
Hidden Lake Pump Station E03036E	$2,699,191	$0	$2,699,191	$2,381,297	88%	5	$5,080,487	$4,354,842	61	86%
Construction Management Services for the Hidden P43017P	$1,500,177	$0	$1,500,177	-$242,947	-16%	2	$1,257,230	$364,938	13	29%
Mitigation for Hidden Lk PS and boeing Creek Trunk Sewer MOA 3415	$1,100,000	$0	$1,100,000	$0	0%		$1,100,000	$1,100,000	1	100%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.010	0.707	0.964	0.694	0.829	0.955	0.544	0.262	0.484	0.389	0.331	0.776
Adopted Plan	0.101	0.528	0.612	0.587	0.822	0.696	0.629	0.604	0.654	0.822	0.721	1.610
Cum. Plan	0.101	0.629	1.241	1.828	2.649	3.345	3.974	4.578	5.232	6.775	6.775	8.384
Cum. Act	-0.010	0.697	1.661	2.355	3.184	4.139	4.683	4.945	5.429	5.818	6.149	6.925

Lifetime Cash Flow



Pre-99 Act 0.068	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Actual Dec-08	0.013	0.043	0.105	0.814	1.814	1.300	2.547	10.10	12.22	6.925		
Budget											2.798	0.000
CumAct+Bdgt	0.081	0.124	0.229	1.043	2.856	4.156	6.703	16.80	29.02	35.95	38.75	38.75

RWSP Project Report
DECEMBER 2008

423406 Juanita Bay PS - Modifications

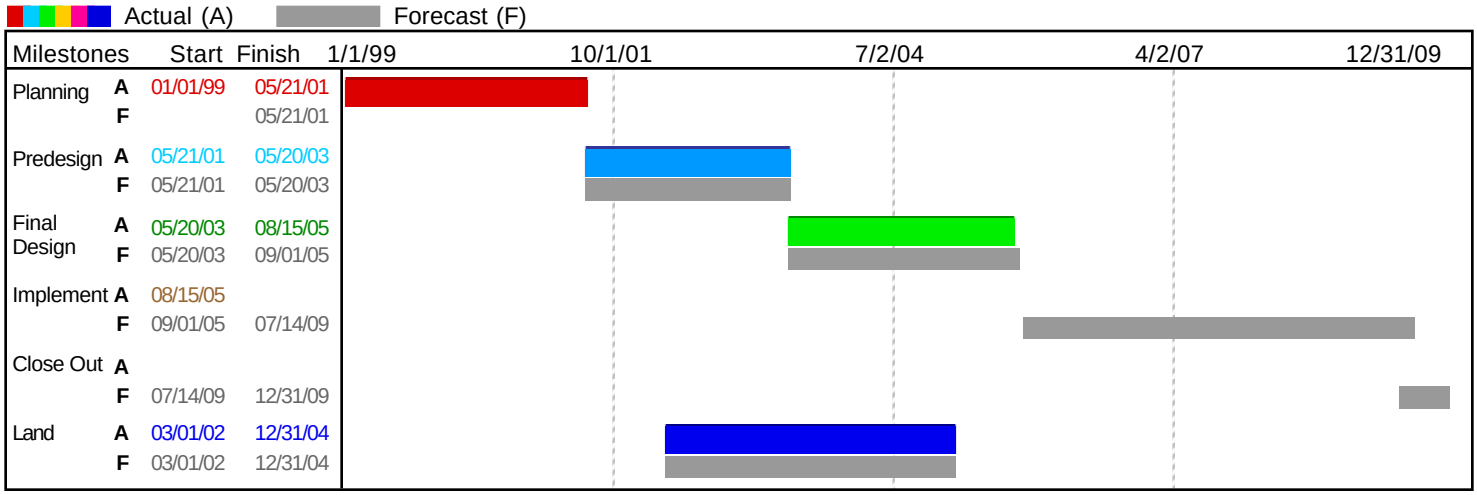
Project Description

This project constructed a 30.6 million gallons per day wastewater pump station to increase the capacity of and replace an aging pump station. The new and replaced pump stations are located at the intersection of NE Juanita Drive and 93rd Ave NE in Kirkland. The station includes four pairs of two-stage pumps, odor control and chemical addition systems for odor and corrosion prevention, equipment lifting devices, equipment sound attenuation, and a standby generator. The new pump station began operating in January 2009.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The construction contractor did not complete contracted work within the required time period, resulting in a schedule delay of about 10 months.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	4,501,871	3,975,385	7,687,163	19,439,991	21,719,286	22,652,460
Construction Contracts	4,501,871	3,909,939	7,623,148	19,418,833	21,600,354	22,540,109
Outside Agency Construction		15,450	15,000	0	15,450	15,000
Other Capital Charges	0	49,996	49,015	21,158	103,482	97,351
NON-CONSTRUCTION	2,369,899	1,373,127	2,188,213	14,847,049	14,280,099	14,970,480
Engineering	839,096	502,500	1,202,500	7,901,627	7,281,648	8,561,701
Planning & Management Svcs.	208,617	23,600	54,000	336,083	174,280	181,466
Permitting & Other Agency Support	48,114	0	46,956	184,915	184,910	183,758
Right-of-Way	0	0	0	1,541,751	1,541,751	1,541,751
Misc. Services & Materials	92,636	25,750	50,000	295,933	204,275	253,297
Staff Labor	1,181,436	821,277	834,757	4,586,739	4,893,234	4,248,508
PROJECT RESERVE		1,065,713	20,000	0	1,075,713	20,000
Project Reserve		1,065,713	20,000	0	1,075,713	20,000
Total $	6,871,770	6,414,225	9,895,376	34,287,039	37,075,098	37,642,941

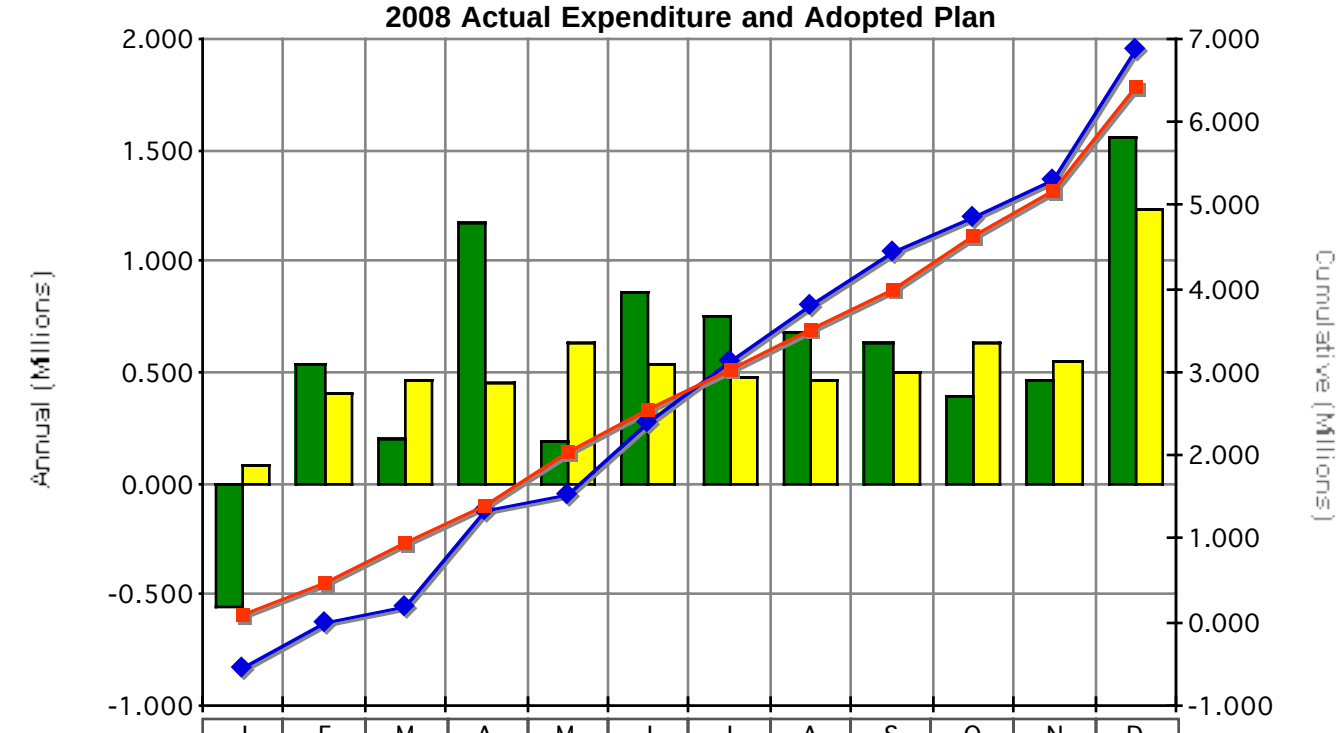
Cost/Budget Adjustments

The construction schedule was not achieved by the construction contractor, which resulted in the need for additional inspection, project management, and engineering services to support the 10-month schedule delay. The need for these additional services resulted in an increase in the lifetime budget.

Contract Status

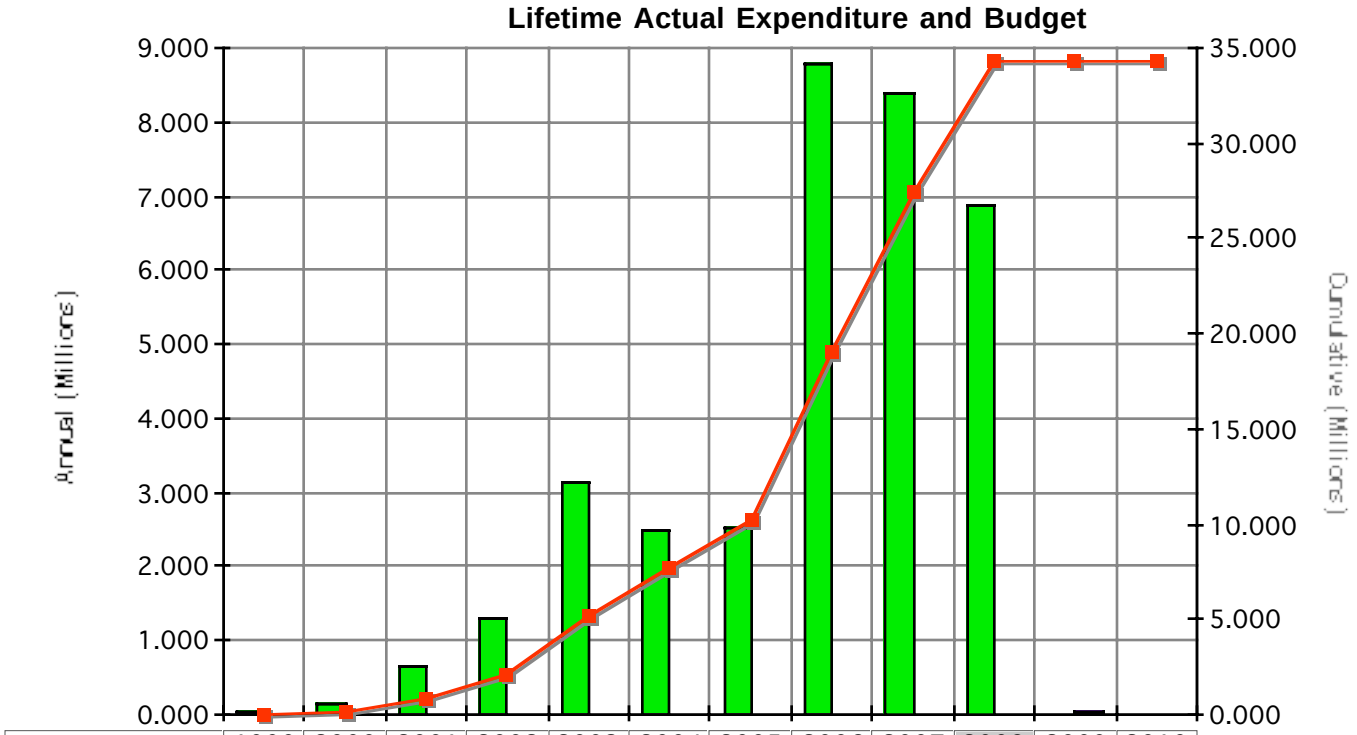
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Juanita Bay Pump Station Replacement C43085C	$18,988,000	$0	$18,988,000	$307,861	2%	8	$19,295,861	$17,452,121	32	90%
Eng'g Services for Juanita Bay & Forcemain Update E03037E	$1,849,354	$6,577,438	$8,426,792	$0	0%	4	$8,426,792	$7,808,305	91	93%
Project Control Services Work Order Contract P00035P07	$500,000	$0	$500,000	$0	0%		$500,000	$268,417	12	54%
Professional Services for Work Order for On Call CM Services P00031P07	$500,000	$0	$500,000	$0	0%		$500,000	$78,539	3	16%
Wastewater Audit Services T02553T	$150,000	$300,000	$450,000	$0	0%	3	$450,000	$305,267	26	68%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.560	0.538	0.201	1.166	0.182	0.859	0.752	0.674	0.633	0.397	0.467	1.562
Adopted Plan	0.077	0.404	0.468	0.449	0.629	0.532	0.481	0.462	0.500	0.629	0.552	1.232
Cum. Plan	0.077	0.481	0.949	1.398	2.027	2.559	3.040	3.502	4.002	5.183	5.183	6.414
Cum. Act	-0.560	-0.021	0.179	1.345	1.528	2.387	3.139	3.814	4.447	4.843	5.310	6.872

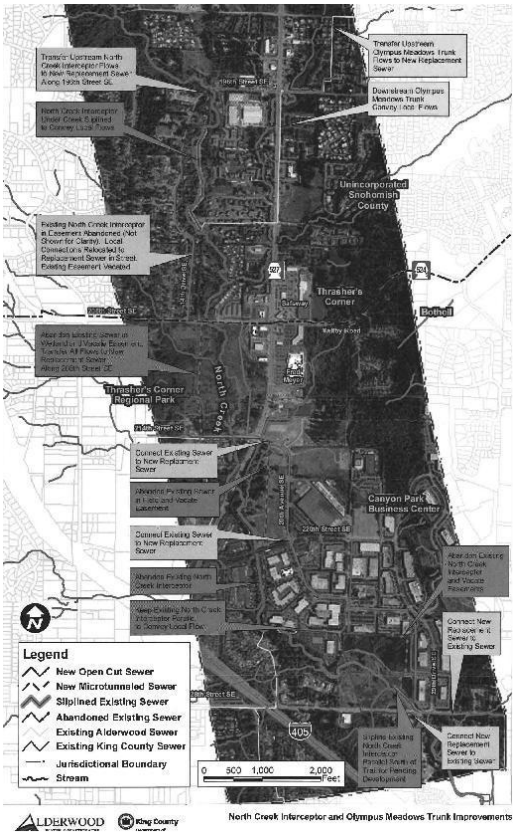
Lifetime Cash Flow



Pre-99 Act 0.008	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Actual Dec-08	0.032	0.151	0.639	1.290	3.125	2.475	2.513	8.800	8.382	6.872		
Budget											0.037	0.000
CumAct+Bdgt	0.039	0.190	0.830	2.120	5.244	7.720	10.23	19.03	27.41	34.28	34.32	34.32

RWSP Project Report
DECEMBER 2008

423596 North Creek Pipeline



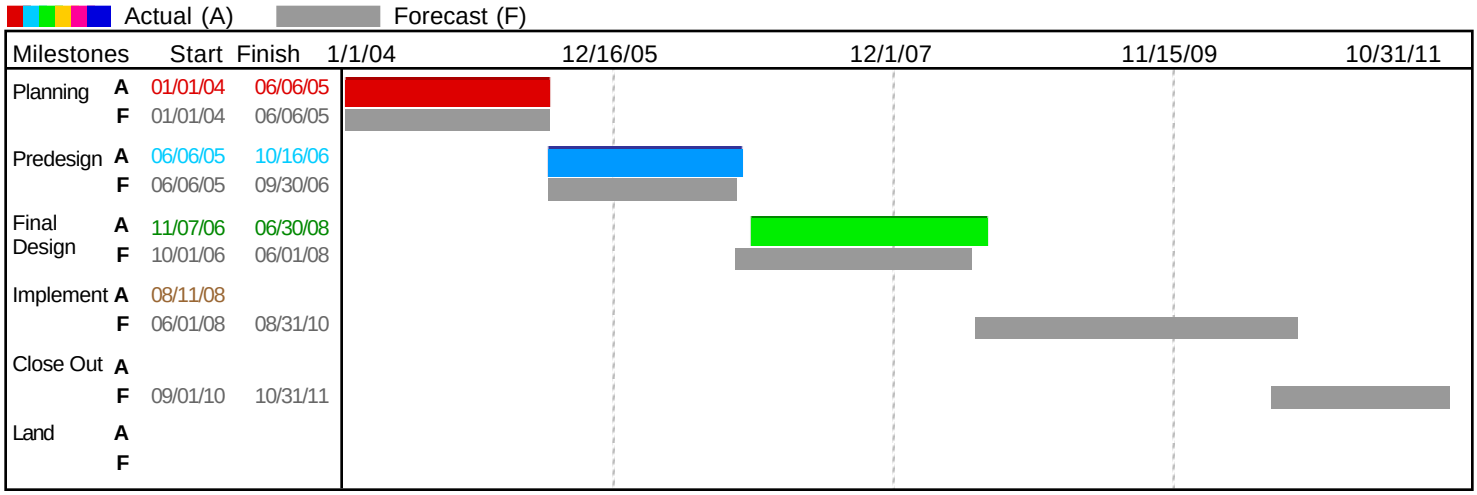
North Creek Interceptor and Olympus Meadows Trunk Improvements

Project Description

Alderwood Water and Wastewater District (AWWD) built the North Creek Interceptor (NCI) in 1969 as the regional conveyance pipeline in the City of Bothell and Snohomish County. In accordance with RWSP conveyance policies, King County purchased the NCI in 2001. Pipeline studies indicated that the NCI is under capacity and requires upgrading. King County signed an interlocal agreement with AWWD for the district to manage design and construction of the project. The improvements will consist of 16,400 feet of gravity sewer pipes, ranging from 21 inches to 48 inches in diameter.

Project Phase: 4 Implementation

Milestone Schedule



Schedule Adjustments

There have been schedule delays in obtaining permits and easements. In addition, there were delays in awarding contracts due to a bid protest resulting in the need to rebid the North Segment.

Cost Summary

	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
Expenses	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION		17,001,755	8,830,911	0	29,805,319	38,093,460
Construction Contracts		17,001,755	8,830,910	0	29,805,318	38,093,460
Outside Agency Construction		0	0	0	0	0
NON-CONSTRUCTION	7,222,453	1,950,722	1,417,334	10,317,323	8,354,813	6,884,142
Engineering	6,192,022	1,438,352	554,959	8,843,450	5,544,011	3,651,824
Planning & Management Svcs.			699,032	0		2,295,880
Permitting & Other Agency Support		0	0	0	553,846	0
Right-of-Way		0	0	0	600,000	0
Misc. Services & Materials	197,490	0	0	243,344	5,396	45,854
Staff Labor	832,941	512,371	163,343	1,230,530	1,651,559	890,584
Total $	7,222,453	18,952,477	10,248,245	10,317,323	38,160,131	44,977,602

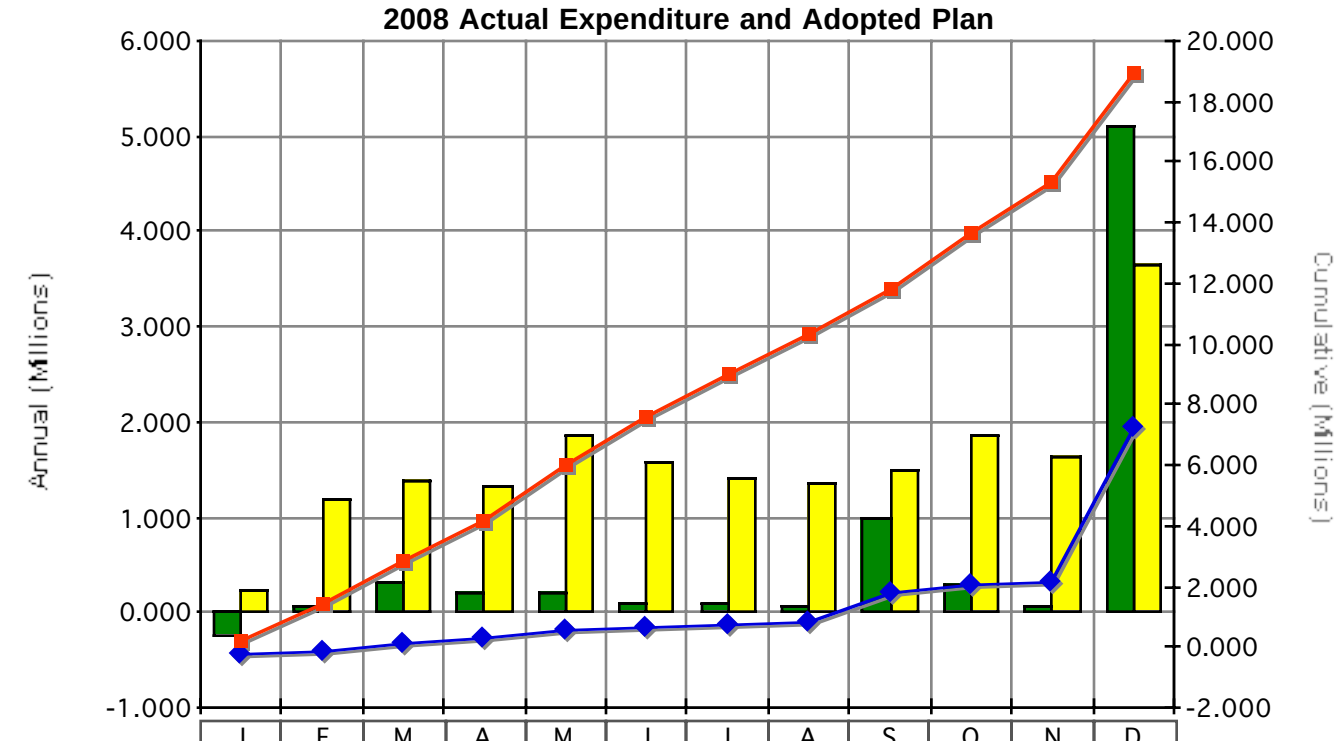
Cost/Budget Adjustments

This project has experienced cost escalation related to increased design costs and higher construction estimates based on an increased number of micro-tunnel and dewatering locations required. There have also been higher than anticipated costs to obtain permits and easements.

Contract Status

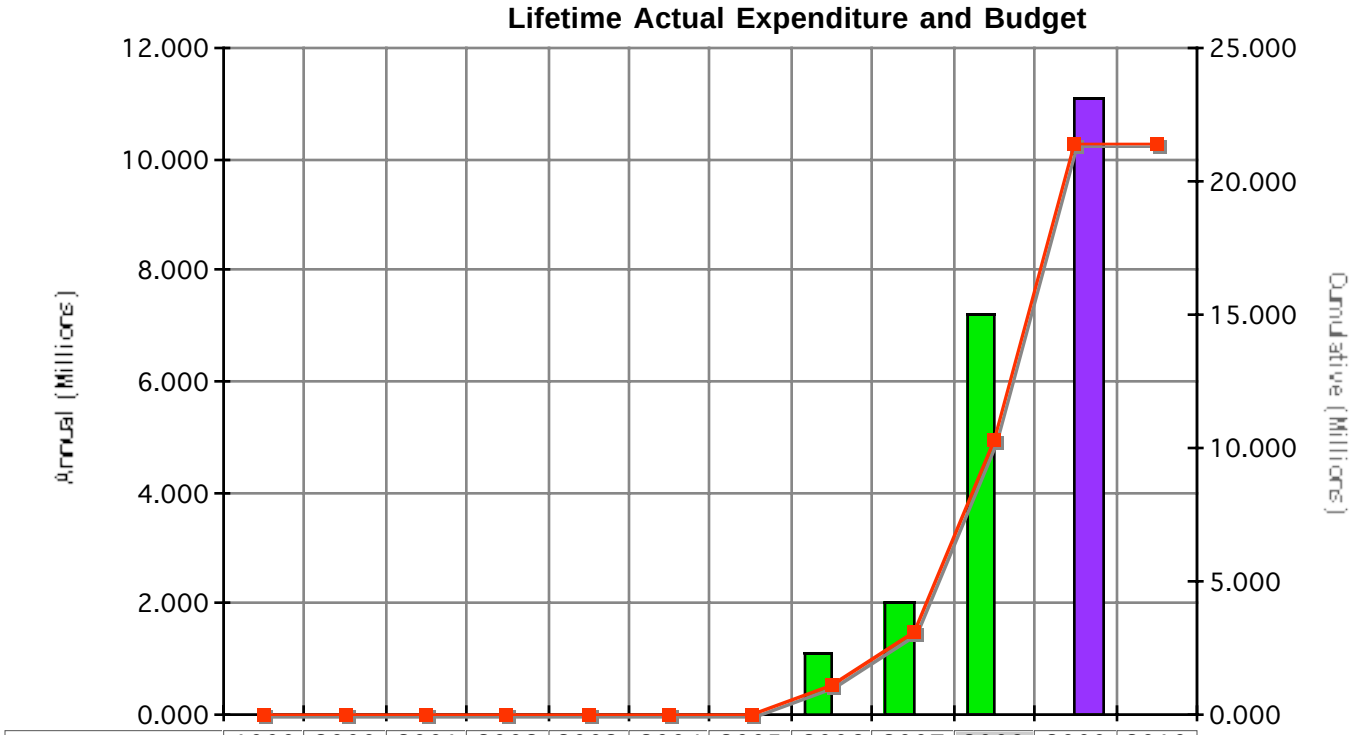
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
North Creek Interceptor Improvements A-NCI-2005	$31,100,000	$0	$31,100,000	$0	0%		$31,100,000	$7,952,556	41	26%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.246	0.066	0.315	0.195	0.214	0.080	0.092	0.063	0.983	0.289	0.076	5.095
Adopted Plan	0.227	1.194	1.384	1.327	1.857	1.573	1.421	1.365	1.478	1.857	1.630	3.639
Cum. Plan	0.227	1.421	2.805	4.132	5.989	7.562	8.983	10.34	11.82	15.31	15.31	18.95
Cum. Act	-0.246	-0.180	0.135	0.330	0.544	0.623	0.716	0.779	1.762	2.051	2.127	7.222

Lifetime Cash Flow



Pre-99 Act 0.000	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Actual Dec-08								1.094	2.001	7.222		
Budget											11.08	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.094	3.095	10.31	21.40	21.40

RWSP Project Report
DECEMBER 2008

423297 RWSP Local Systems I/I Control

Project Description

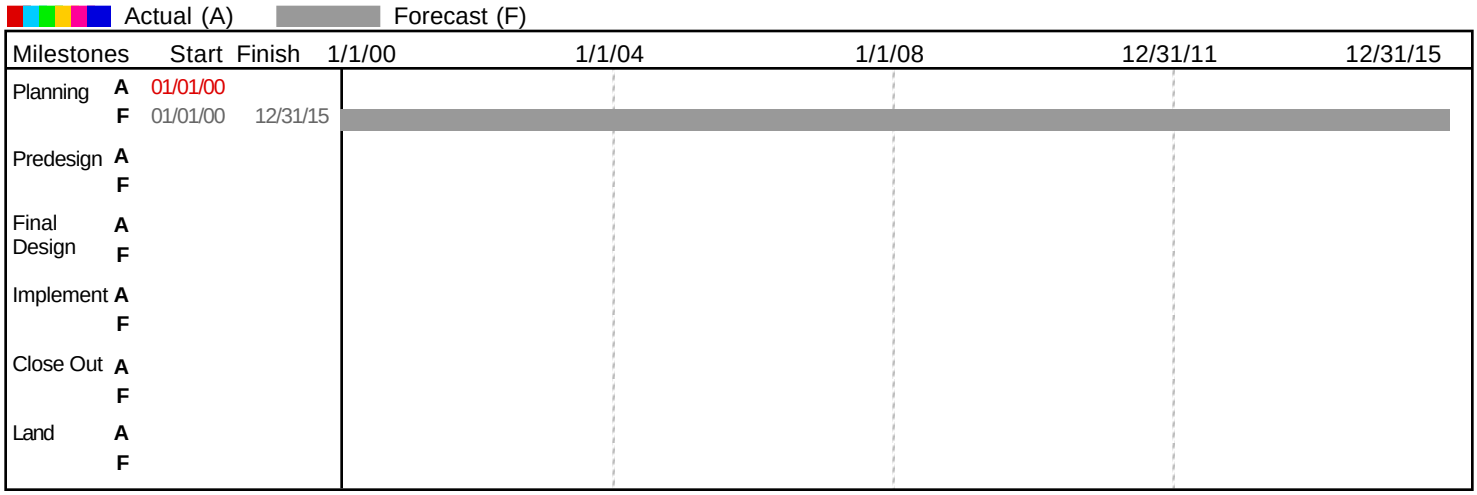
The Inflow/Infiltration (I/I) Control Program is designed to reduce I/I that flows into the county's wastewater conveyance and treatment system. In accordance with the RWSP, this program consisted of all the elements of the six-year comprehensive I/I study, which included regional flow monitoring, 10 pilot I/I reduction projects, a regional needs assessment, benefit-cost analyses, and development of draft design guidelines. This program has been carried out in close coordination with the Metropolitan Water Pollution Abatement Advisory Committee. The Executive's Recommended I/I Program, which was approved by the King County Council through Motion 12292 in May 2006, resulted from these efforts. The recommended program includes implementation of initial I/I reduction projects (Project #423618).

The current scope of this project is to monitor progress on the implementation of the initial I/I projects for consistency with the approved Regional I/I Control Program.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	40,901	0	0	5,916,359	5,811,555	5,875,459
Construction Contracts	40,901	0	0	5,701,823	5,419,822	5,660,922
Owner Furnished Equipment	0	0	0	205,406	27,046	205,406
Other Capital Charges	0	0	0	9,131	364,687	9,131
NON-CONSTRUCTION	79,257	242,984	68,142	34,162,624	35,720,831	35,631,616
Engineering	-29,000	0	0	25,531,736	25,646,750	25,903,737
Planning & Management Svcs.	0	0	0	99,485	45,533	220,718
Permitting & Other Agency Support	0	0	0	1,865,036	1,865,036	1,865,036
Misc. Services & Materials	9,805	28,892	13,381	720,619	1,066,514	797,366
Staff Labor	98,452	214,092	54,761	5,945,747	7,096,998	6,844,758
PROJECT RESERVE		853	828	0	2,495,466	461,793
Project Reserve		853	828	0	2,495,466	461,793
CREDITS AND REVENUES	0	0	0	-2	-2	-2
Credits and Revenues	0	0	0	-2	-2	-2
Total $	120,158	243,837	68,970	40,078,982	44,027,850	41,968,865

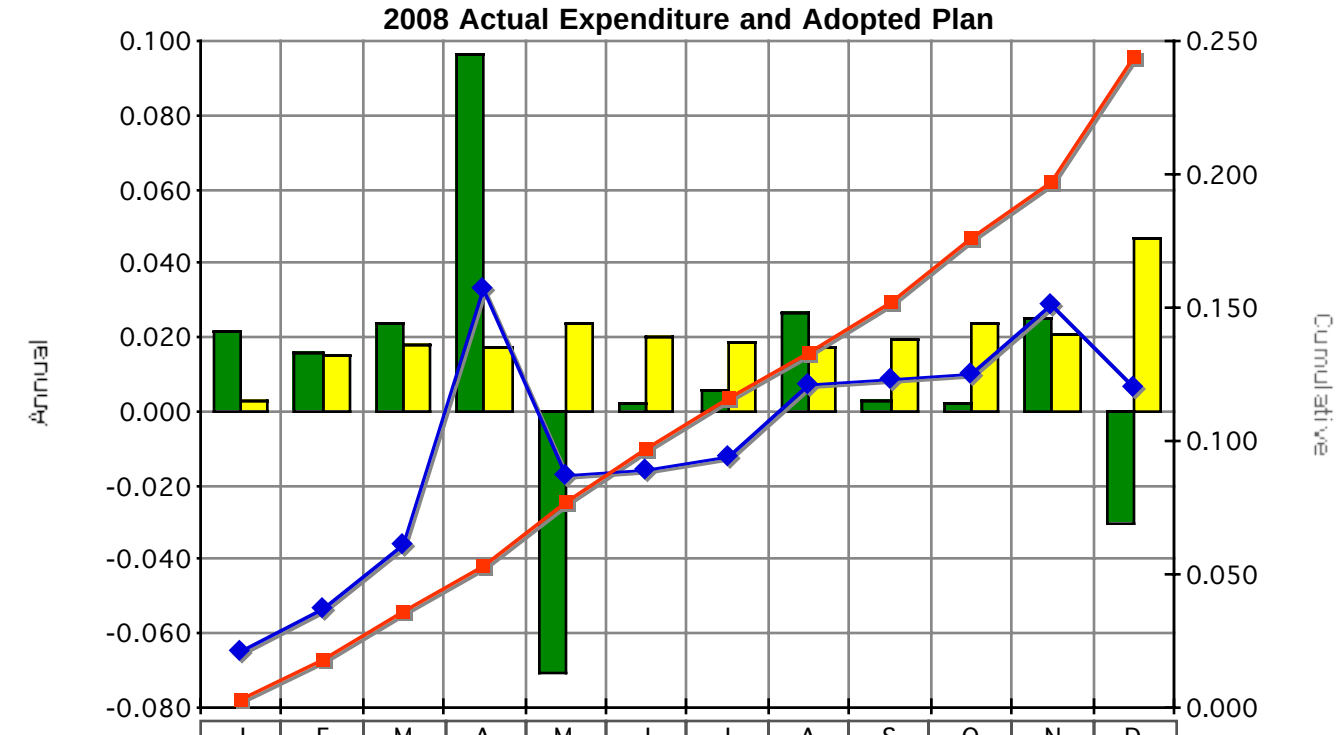
Cost/Budget Adjustments

The lifetime budget estimate has been reduced to reflect the current scope of this project--to monitor progress on the implementation of the initial I/I projects for consistency with the approved Regional I/I Control Program.

Contract Status

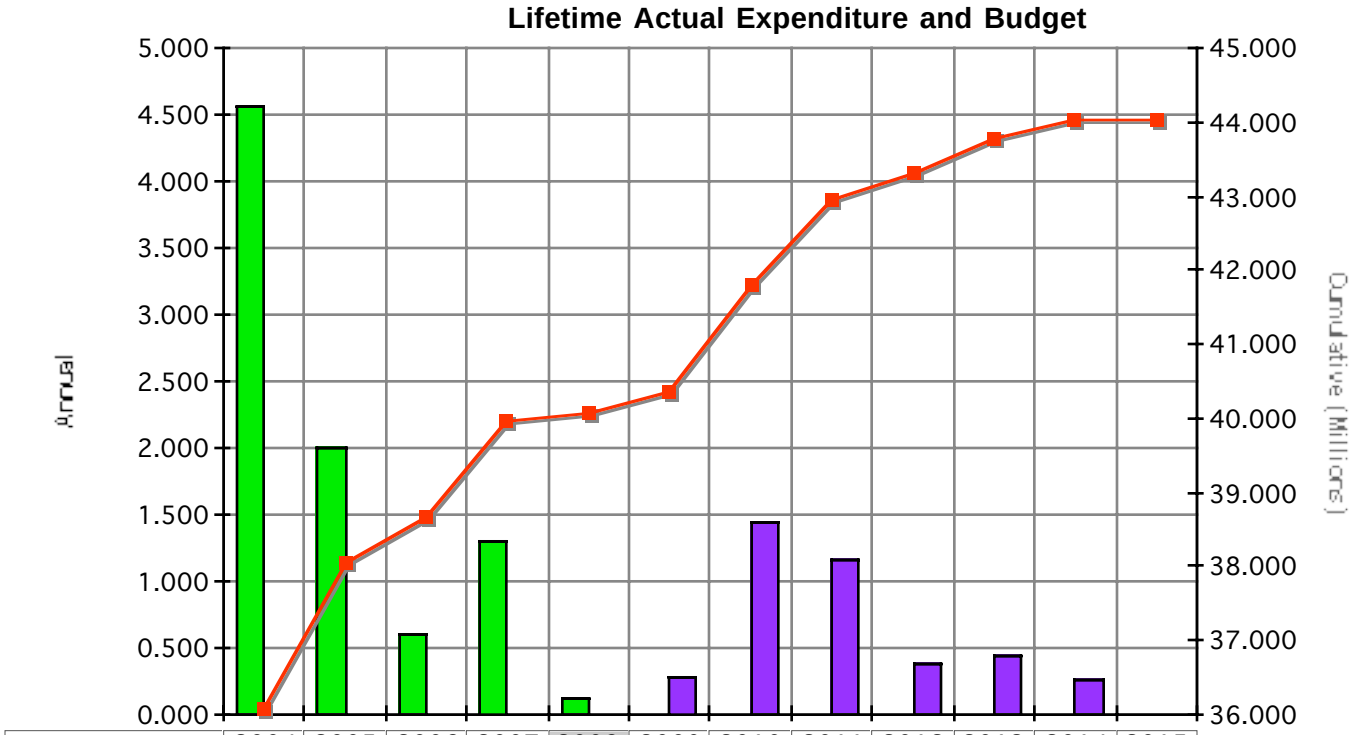
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Regional Inflow/Infiltration Control Project E93051E	$19,410,131	$0	$19,410,131	$8,445,941	44%	4	$27,856,072	$25,104,624	81	90%
Engineering Services for Initial Infiltration/Inflow Reduction E00057E07	$1,393,139	$0	$1,393,139	$6,076	0%	1	$1,399,215	$791,101	16	57%
Kent Infiltration and Inflow (I/I) Pilot Project C33044C	$1,099,544	$0	$1,099,544	-$106,298	-10%	1	$993,246	$993,246	7	100%
Redmond Infiltration and Inflow (I/I) Pilot Project C33048C	$899,117	$0	$899,117	$18,117	2%	3	$917,234	$772,158	4	84%
Lake Forest Park I/I Project c33046c	$801,893	$0	$801,893	-$7,508	-1%	1	$794,385	$726,489	4	91%
Kirkland Infiltration and Inflow (I/I) Pilot Project C33045C	$781,775	$0	$781,775	$12,843	2%	1	$794,618	$770,394	4	97%
Mercer Island Infiltration and Inflow (I/I) Pilot Project C33047C	$736,654	$0	$736,654	$13,163	2%	2	$749,817	$740,557	3	99%
Miscellaneous Pipe Repair and Restoration C33060C	$500,000	$0	$500,000	$0	0%	1	$500,000	$499,704	17	100%
Brier Infiltration and Inflow (I/I) Pilot Project C33043C	$425,359	$0	$425,359	-$36,643	-9%	1	$388,716	$342,226	5	88%
Auburn Infiltration and Inflow (I/I) Pilot Project C33042C	$324,675	$0	$324,675	$28,944	9%	2	$353,619	$353,619	4	100%
Manhole I & I C33120C	$220,990	$0	$220,990	$11,000	5%	1	$231,990	$184,580	5	80%
Engineering Support for Regional I/I Control Prog E83043E	$149,935	$0	$149,935	$0	0%		$149,935	$149,935	10	100%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.021	0.016	0.024	0.096	-0.070	0.002	0.006	0.026	0.003	0.002	0.025	-0.031
Adopted Plan	0.003	0.015	0.018	0.017	0.024	0.020	0.018	0.018	0.019	0.024	0.021	0.047
Cum. Plan	0.003	0.018	0.036	0.053	0.077	0.097	0.116	0.133	0.152	0.197	0.197	0.244
Cum. Act	0.021	0.037	0.061	0.157	0.087	0.089	0.094	0.121	0.123	0.125	0.151	0.120

Lifetime Cash Flow



Pre-04 Act 31.503	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Actual Dec-08	4.552	2.000	0.597	1.307	0.120							
Budget						0.273	1.432	1.157	0.378	0.444	0.257	0.000
CumAct+Bdgt	36.05	38.05	38.65	39.95	40.07	40.35	41.78	42.94	43.31	43.76	44.02	44.02

RWSP Project Report
DECEMBER 2008

423618 RWSP Local Systems I/I Implementation

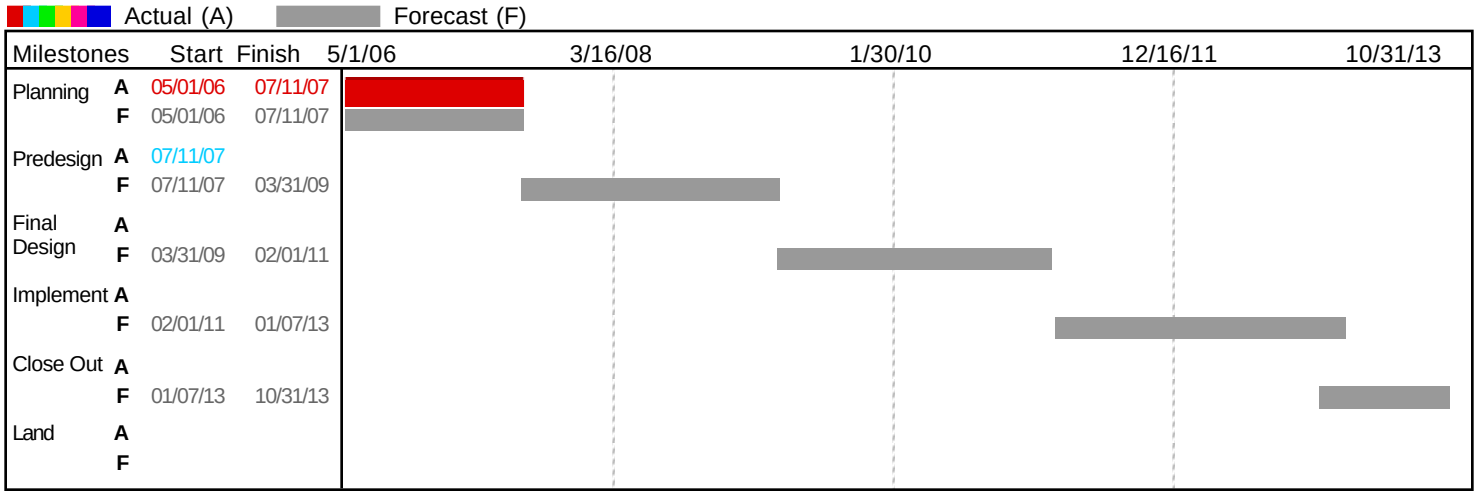
Project Description

The Executive's Recommended Infiltration and Inflow (I/I) Program, approved by the King County Council through Motion 12292 in May 2006, recommended implementation of two to three Initial I/I Reduction Projects. Four candidate project areas were selected by the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) to be evaluated in predesign. As a result of the alternatives analysis and in consultation with MWPAAC and the host agencies, two projects were selected for final design and construction: a combined Bellevue and Issaquah project and a Skyway project. The Initial I/I Reduction Projects will provide information to help determine (1) whether they were able to reduce I/I levels to a point where enough capacity was relieved to delay, downsize, or eliminate the need for downstream Conveyance System Improvement projects, and (2) whether I/I reduction on this scale is cost-effective.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	204,004	412,000	233,604	204,004	20,376,120	14,637,566
Construction Contracts	204,004	0	0	204,004	19,964,120	14,376,770
Owner Furnished Equipment			233,604	0		260,796
Other Capital Charges		412,000	0	0	412,000	0
NON-CONSTRUCTION	917,737	1,359,132	1,309,051	917,737	6,193,085	4,360,346
Engineering	623,001	1,113,271	975,000	623,001	4,920,358	2,331,389
Planning & Management Svcs.	779	0	0	779	0	0
Permitting & Other Agency Support	559	0	0	559	0	52,202
Misc. Services & Materials	23,456	7,662	29,205	23,456	49,561	156,194
Staff Labor	269,942	238,198	304,846	269,942	1,223,166	1,820,561
PROJECT RESERVE			0	0		776,134
Project Reserve			0	0		776,134
Total $	1,121,741	1,771,132	1,542,655	1,121,741	26,569,206	19,774,046

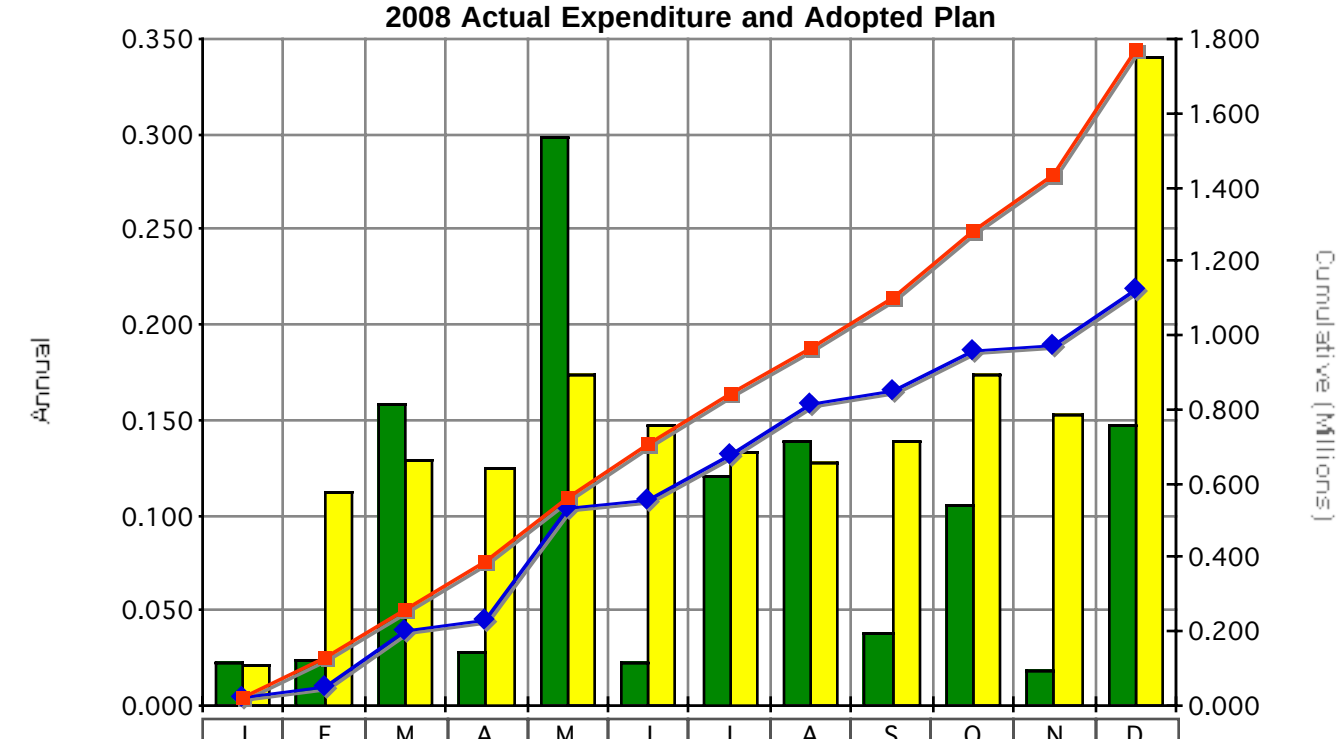
Cost/Budget Adjustments

The budget was reduced because the alternatives that have been selected have a lower total project cost than the projected planning-level budget.

Contract Status

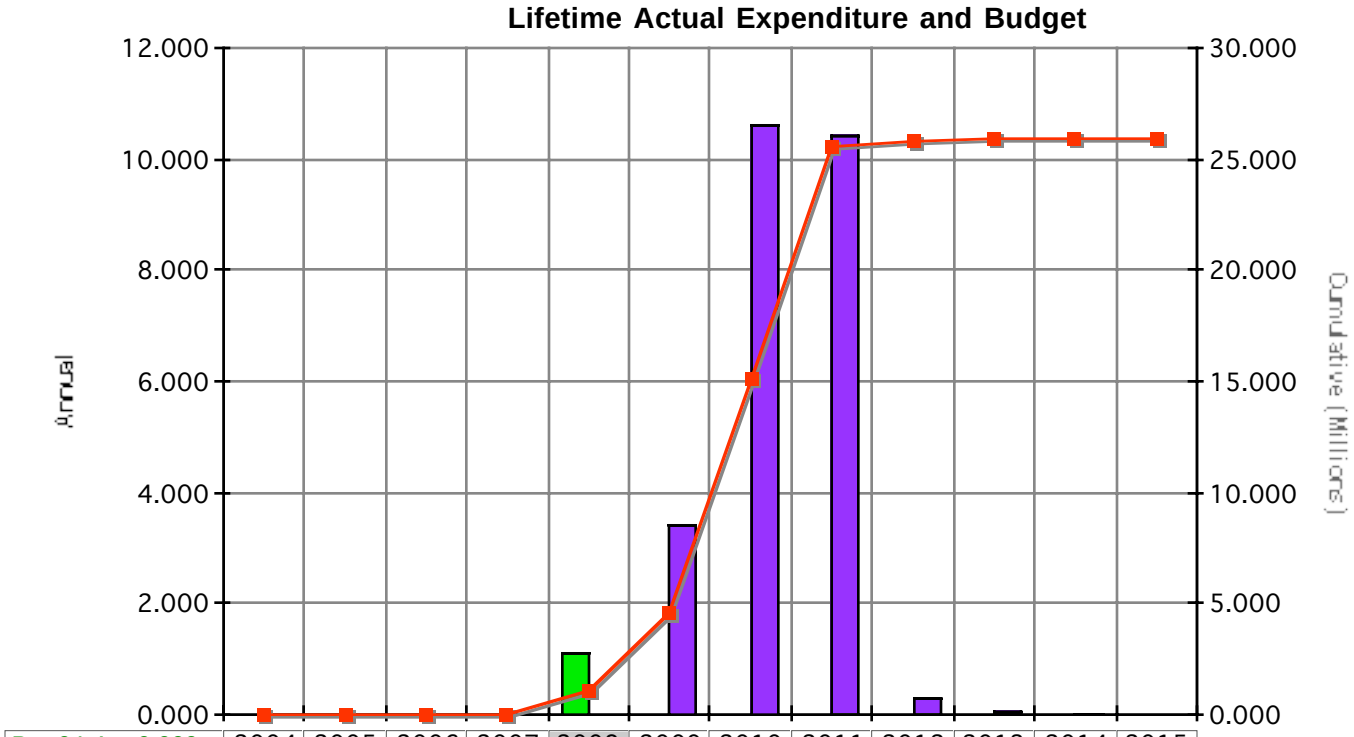
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Engineering Services for Initial Infiltration/Inflow Reduction E00057E07	$1,393,139	$0	$1,393,139	$6,076	0%	1	$1,399,215	$791,101	16	57%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.023	0.024	0.158	0.028	0.299	0.023	0.121	0.138	0.038	0.106	0.018	0.147
Adopted Plan	0.021	0.112	0.129	0.124	0.174	0.147	0.133	0.128	0.138	0.174	0.152	0.340
Cum. Plan	0.021	0.133	0.262	0.386	0.560	0.707	0.840	0.967	1.105	1.431	1.431	1.771
Cum. Act	0.023	0.047	0.205	0.233	0.531	0.554	0.675	0.813	0.851	0.957	0.974	1.122

Lifetime Cash Flow



Pre-04 Act 0.000	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Actual Dec-08					1.122							
Budget						3.409	10.60	10.42	0.299	0.051	0.014	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	1.122	4.531	15.13	25.55	25.85	25.90	25.92	25.92

RWSP Project Report
DECEMBER 2008

423593 WP Digestion Improvements

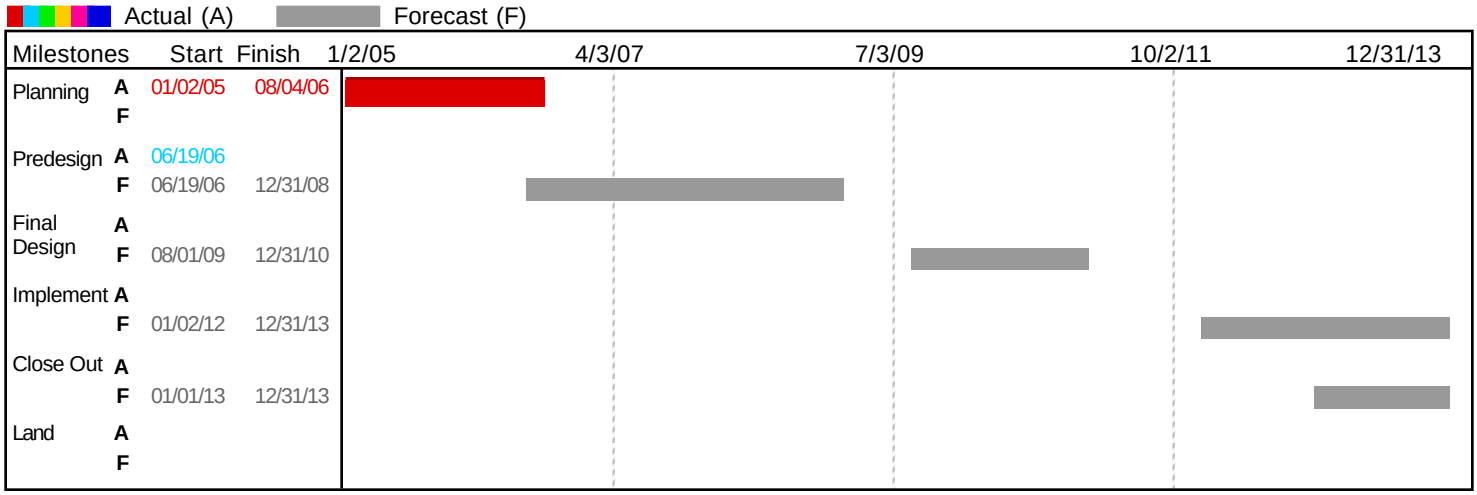
Project Description

The purpose of this project is to design and implement improvements to the West Point Treatment Plant solids digestion system to improve system reliability. Improvements will include modifications to the blending storage tank (Digester 6) to enable its use as an emergency active digester, modifications to solids conveyance systems to enable continuous digester feed and withdrawal, and installation of new mixing system for Digesters 4 and 5.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

Due to budgetary constraints, project implementation has been delayed until 2012.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	0	500,030	15,450	92	3,462,034	6,167,349
Construction Contracts		484,116	0	0	3,430,671	6,151,807
Owner Furnished Equipment	0		0	92		92
Other Capital Charges		15,914	15,450	0	31,364	15,450
NON-CONSTRUCTION	124,667	598,743	693,550	833,527	1,734,940	3,680,760
Engineering	45,819	403,279	450,000	363,492	1,003,178	1,715,110
Planning & Management Svcs.			50,000	0		177,654
Misc. Services & Materials	16,474	14,831	14,399	43,646	45,244	100,624
Staff Labor	62,375	180,634	179,151	426,389	686,518	1,687,372
PROJECT RESERVE		0	0	0	1,152,827	1,357,352
Project Reserve		0	0	0	1,152,827	1,357,352
Total $	124,667	1,098,773	709,000	833,619	6,349,801	11,205,461

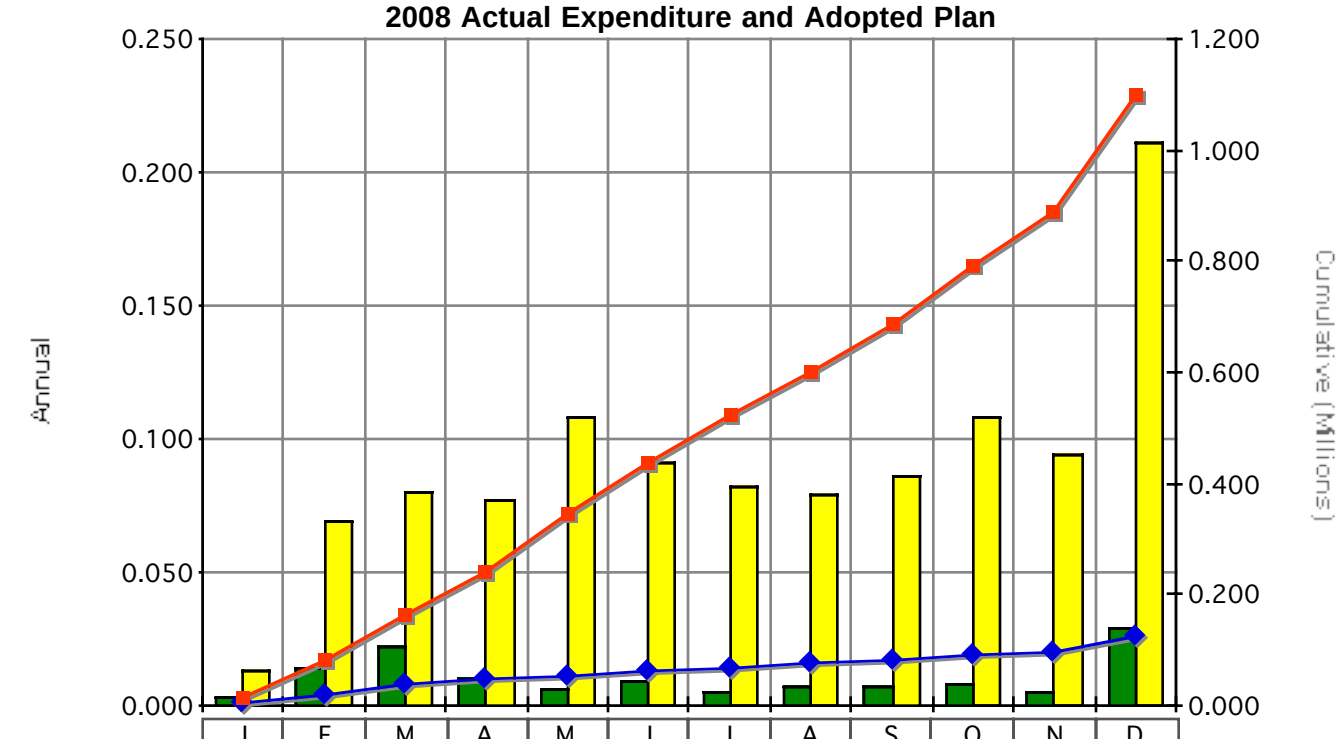
Cost/Budget Adjustments

The change in the lifetime budget cost estimate reflects updated construction cost estimates based on the final predesign report. Associated costs were updated accordingly. Baseline costs will be developed during final design. Phasing of project components will also be evaluated.

Contract Status

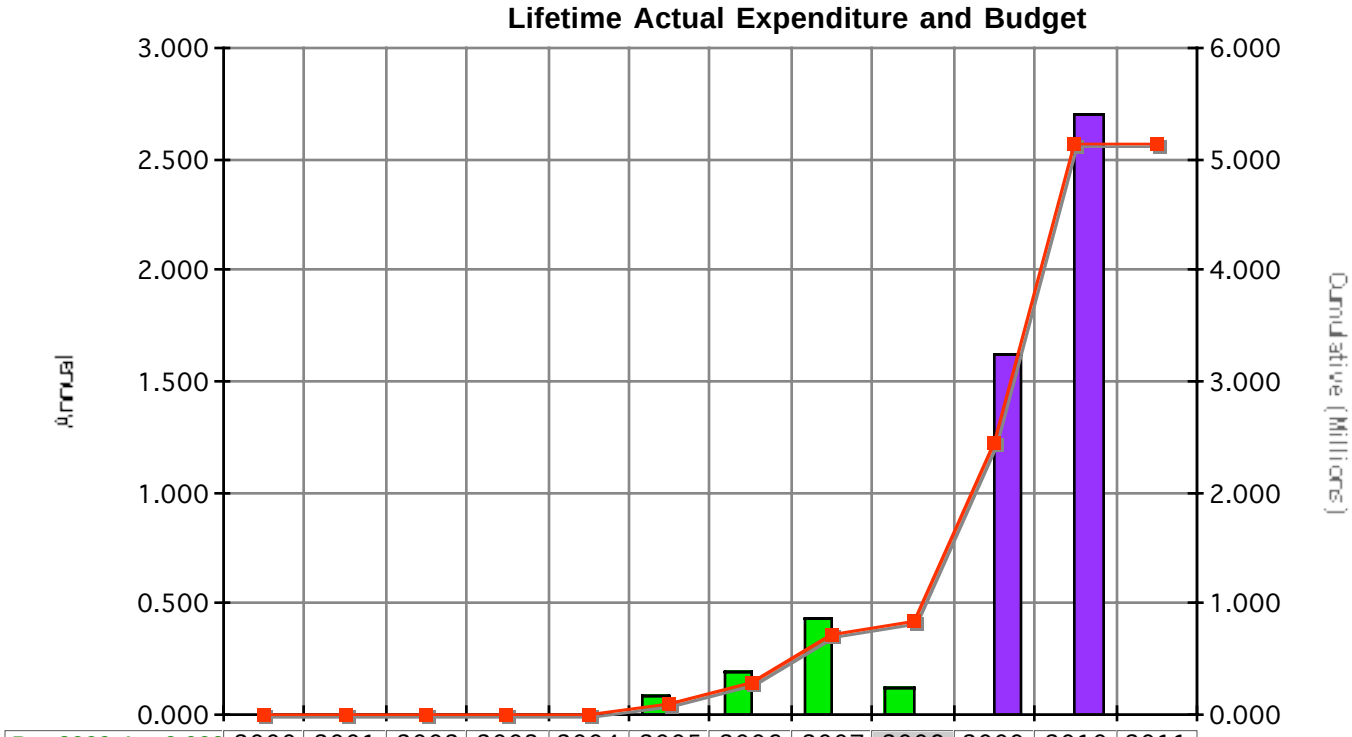
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
West Point Treatment Plant Digestion System E53025E	$382,148	$0	$382,148	$0	0%		$382,148	$341,961	24	89%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	0.003	0.014	0.022	0.010	0.006	0.009	0.005	0.007	0.007	0.008	0.005	0.029
Adopted Plan	0.013	0.069	0.080	0.077	0.108	0.091	0.082	0.079	0.086	0.108	0.094	0.211
Cum. Plan	0.013	0.082	0.163	0.240	0.347	0.438	0.521	0.600	0.686	0.888	0.888	1.099
Cum. Act	0.003	0.017	0.039	0.049	0.055	0.064	0.069	0.076	0.083	0.091	0.096	0.125

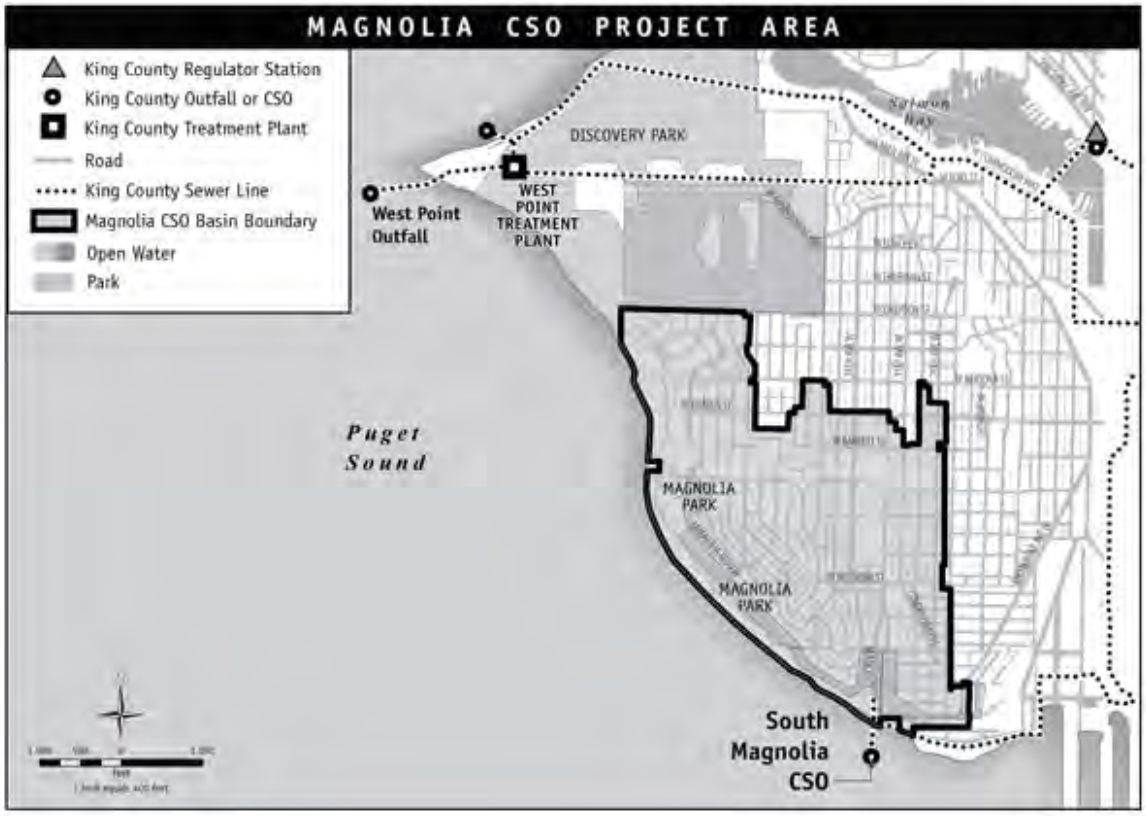
Lifetime Cash Flow



Pre-2000 Act 0.000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Actual Dec-08						0.088	0.194	0.426	0.125			
Budget										1.615	2.698	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.088	0.283	0.709	0.834	2.449	5.147	5.147

RWSP Project Report
DECEMBER 2008

423607 CSO Control & Improvements - Magnolia



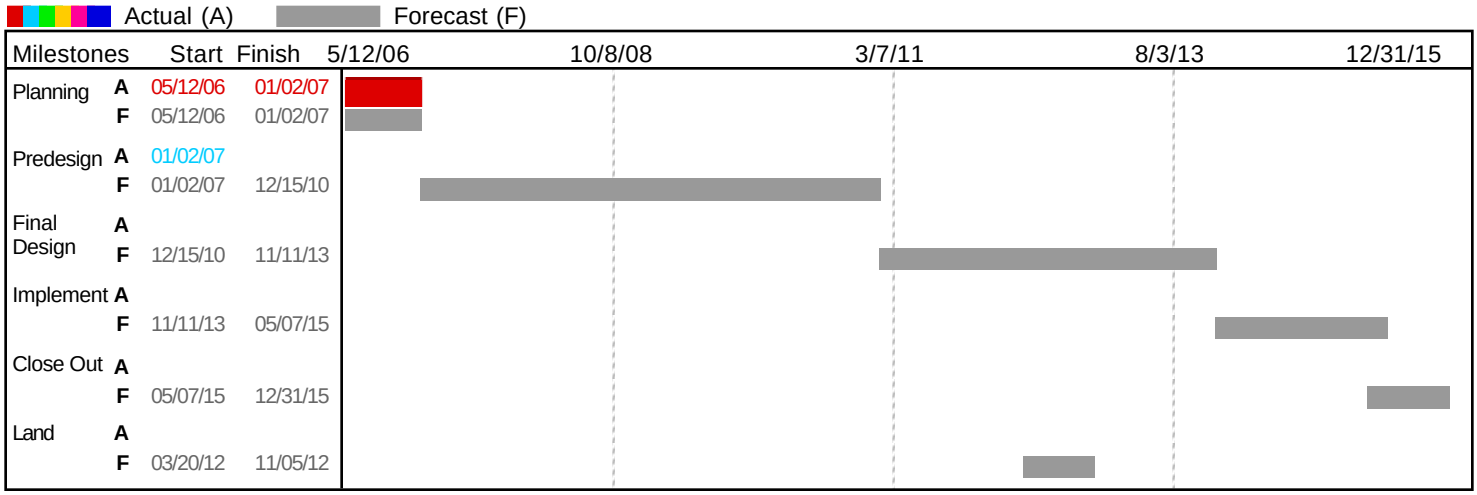
Project Description

This project will design and construct a Combined Sewer Overflow (CSO) control facility to control the CSOs at the South Magnolia outfall to meet state regulations of no more than one CSO per year per location on average.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The project schedule has been extended in order to conduct additional flow monitoring and pump testing to calculate the storage volume needed. This information will be used to evaluate additional project alternatives, including reducing stormwater inflow.

Cost Summary

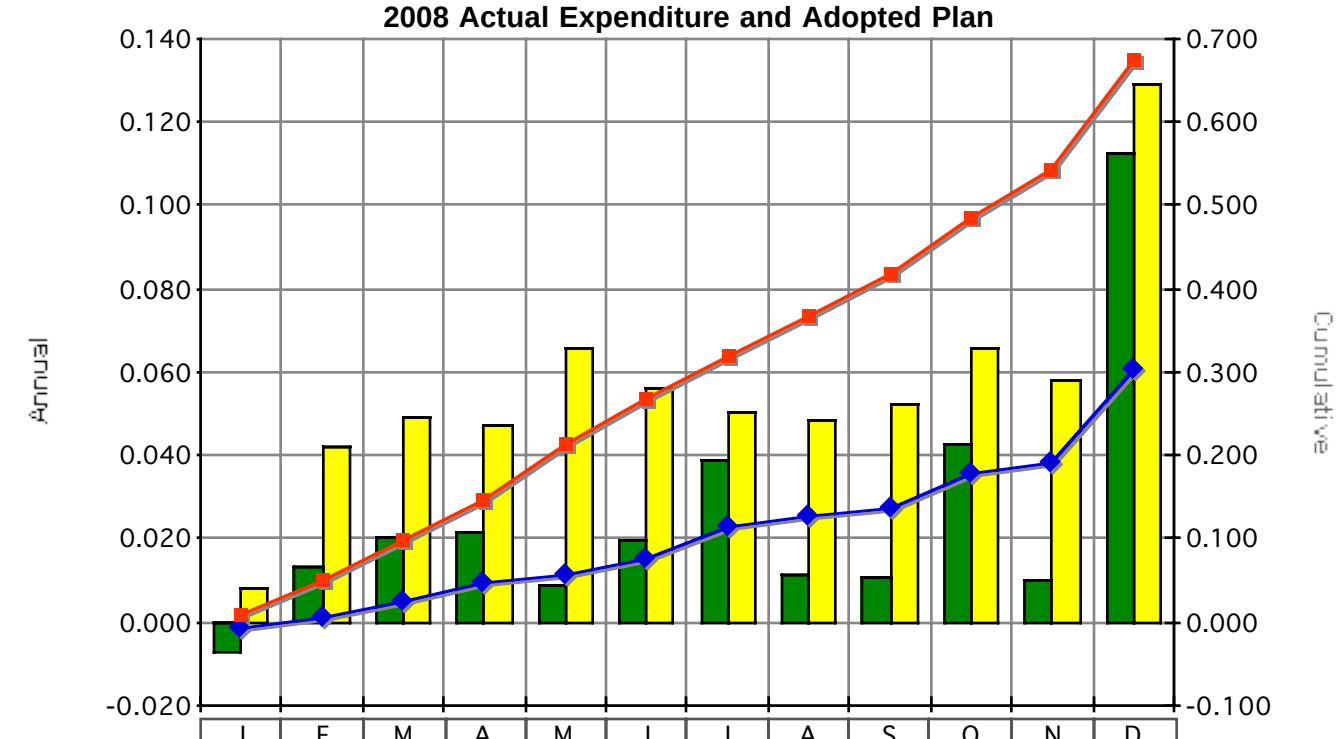
	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
Expenses	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	37,425	0	0	37,425	4,913,453	4,511,917
Construction Contracts	3,090	0	0	3,090	4,796,021	4,396,185
Owner Furnished Equipment	34,335	0	0	34,335	0	0
Outside Agency Construction		0	0	0	9	9
Other Capital Charges		0	0	0	117,422	115,723
NON-CONSTRUCTION	264,557	672,851	457,459	437,046	2,251,047	2,632,392
Engineering	117,408	515,136	362,400	221,589	1,062,389	1,476,441
Planning & Management Svcs.	49,690	0	0	49,690	7	8
Permitting & Other Agency Support		0	0	0	83,587	83,588
Right-of-Way		0	0	0	35,981	35,981
Misc. Services & Materials	6,655	0	0	11,219	0	4,565
Staff Labor	90,805	157,715	95,059	154,548	1,069,084	1,031,811
PROJECT RESERVE		0	0	0	984,246	984,246
Project Reserve		0	0	0	984,246	984,246
Total $	301,983	672,851	457,459	474,471	8,148,746	8,128,557

Cost/Budget Adjustments

Contract Status

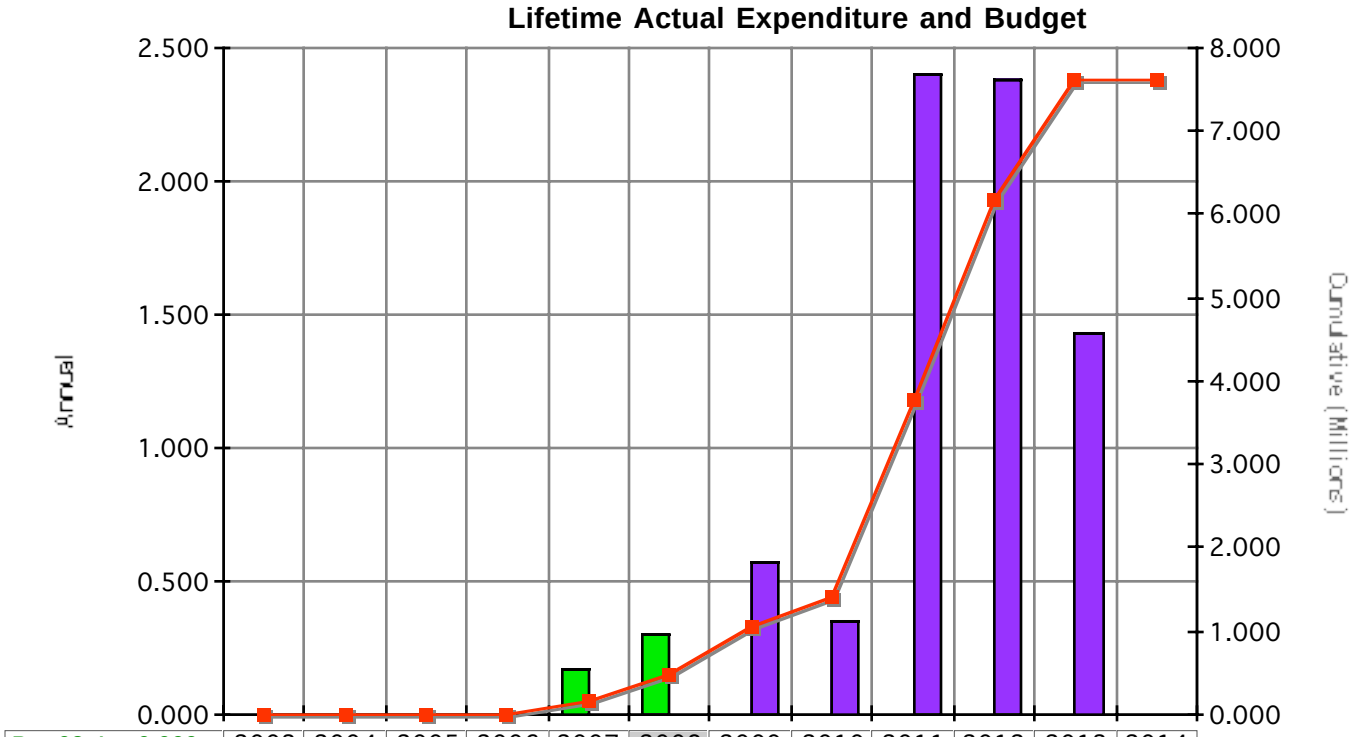
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Barton, Murray, Magnolia, & North Beach Combined Sewer E00022E06	$4,468,869	$0	$4,468,869	$1,545,006	35%	2	$6,013,874	$1,084,691	22	18%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.007	0.013	0.020	0.022	0.008	0.019	0.039	0.011	0.011	0.043	0.010	0.112
Adopted Plan	0.008	0.042	0.049	0.047	0.066	0.056	0.050	0.048	0.052	0.066	0.058	0.129
Cum. Plan	0.008	0.050	0.100	0.147	0.213	0.268	0.319	0.367	0.420	0.544	0.544	0.673
Cum. Act	-0.007	0.006	0.026	0.048	0.056	0.076	0.115	0.126	0.137	0.180	0.190	0.302

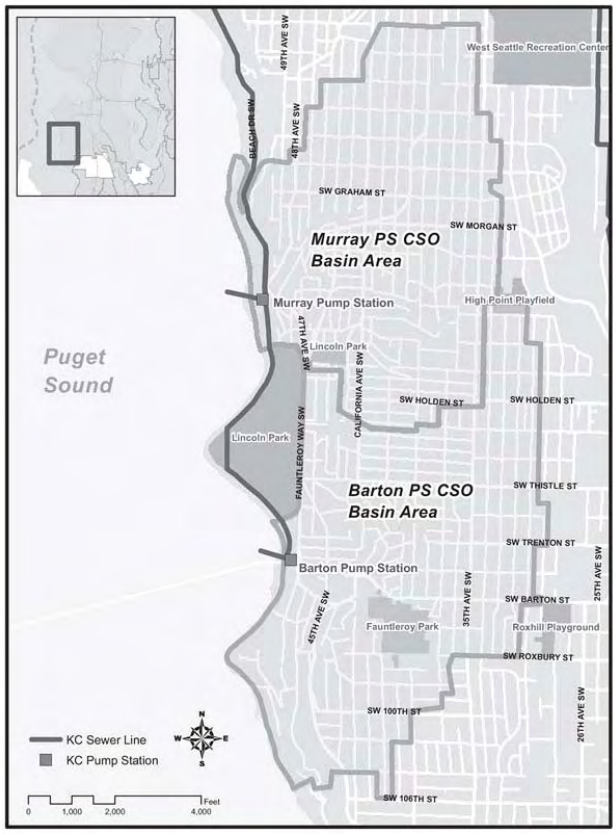
Lifetime Cash Flow



Pre-03 Act 0.000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Actual Dec-08					0.172	0.302						
Budget							0.567	0.352	2.396	2.383	1.433	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.172	0.474	1.041	1.394	3.790	6.172	7.605	7.605

RWSP Project Report
DECEMBER 2008

423608 CSO Control & Improvements - Murray



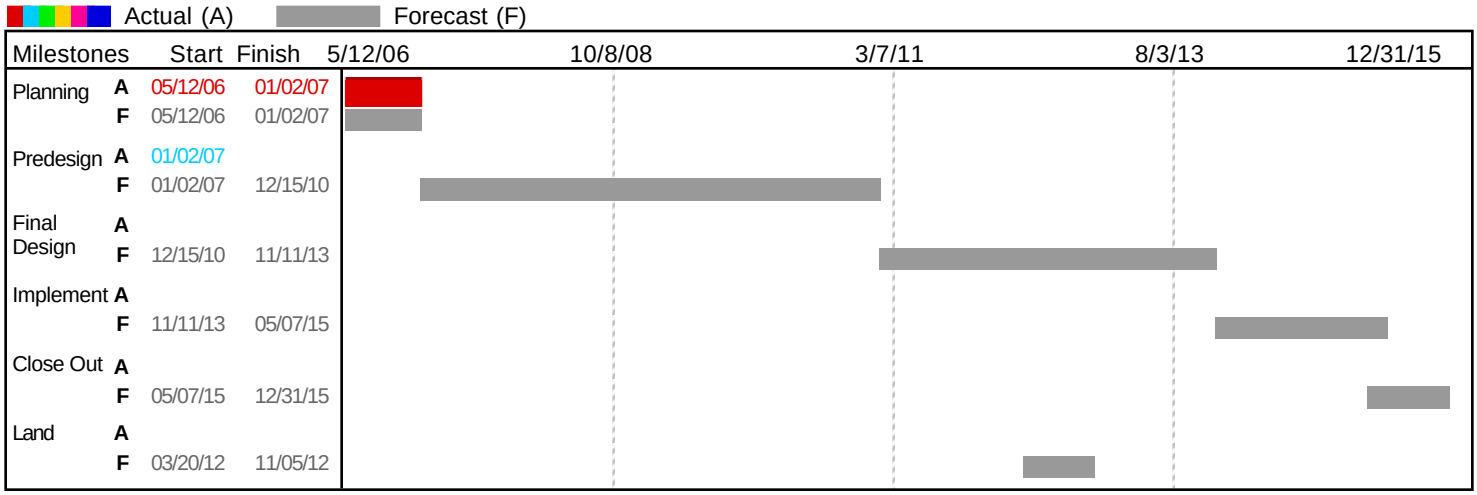
Project Description

This project will design and construct a Combined Sewer Overflow (CSO) control facility or other drainage basin improvements to control the CSOs at the Murray Pump Station to meet state regulations of no more than one CSO per year per location on average.

Project Phase: 1 Development

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The project schedule has been extended in order to conduct additional flow monitoring and pump testing to calculate the storage volume needed. This information will be used to evaluate additional project alternatives, including reducing stormwater inflow.

Cost Summary

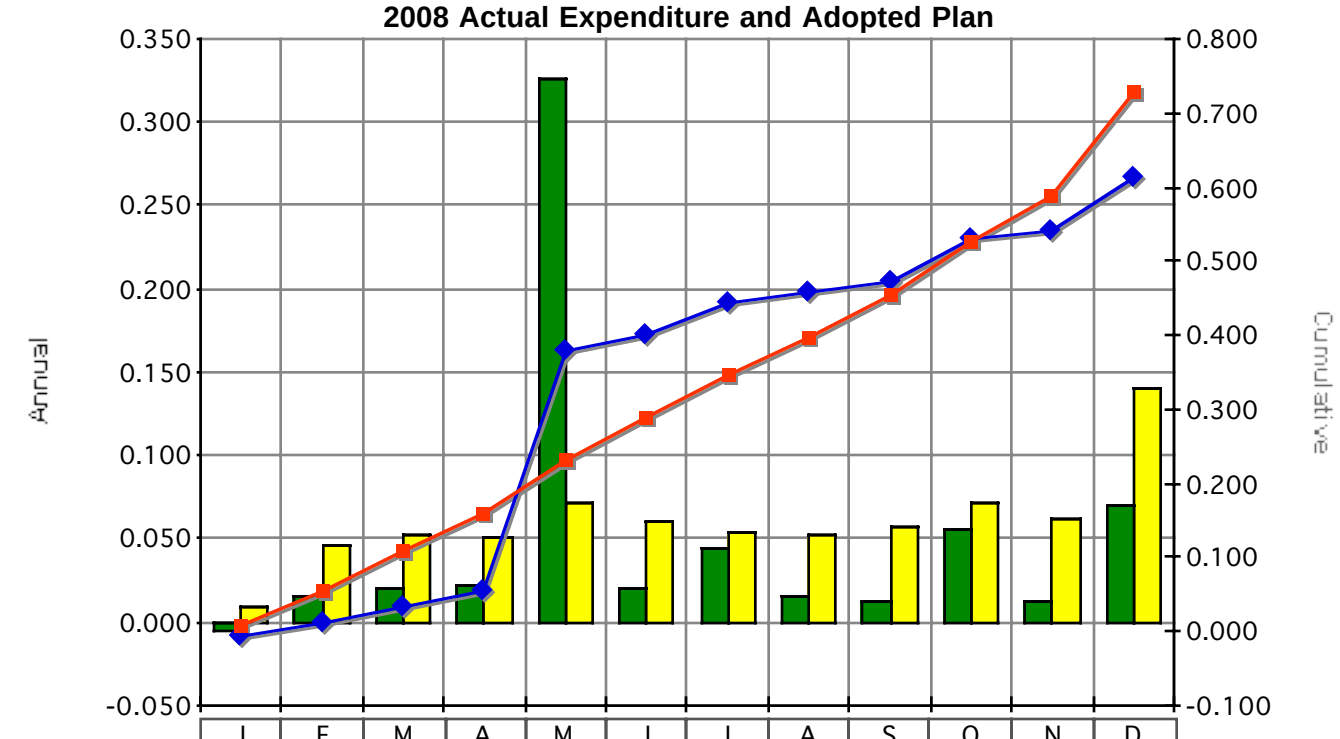
	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
Expenses	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	30,163	0	0	30,163	3,740,058	3,332,087
Construction Contracts	2,491	0	0	2,491	3,651,724	3,245,032
Owner Furnished Equipment	27,672	0	0	27,672	0	0
Outside Agency Construction		0	0	0	9	9
Other Capital Charges		0	0	0	88,325	87,046
NON-CONSTRUCTION	581,058	727,637	469,807	750,796	2,220,905	2,557,077
Engineering	121,511	617,059	396,051	247,337	1,250,482	1,631,560
Planning & Management Svcs.	32,709	0	0	32,709	7	7
Permitting & Other Agency Support	1,303	0	0	1,303	62,875	62,875
Right-of-Way	318,292	0	0	318,292	113,370	113,370
Misc. Services & Materials	7,872	0	0	10,246	0	2,374
Staff Labor	99,372	110,578	73,756	140,910	794,172	746,891
PROJECT RESERVE		0	0	0	1,261,916	1,261,916
Project Reserve		0	0	0	1,261,916	1,261,916
Total $	611,221	727,637	469,807	780,959	7,222,879	7,151,080

Cost/Budget Adjustments

Contract Status

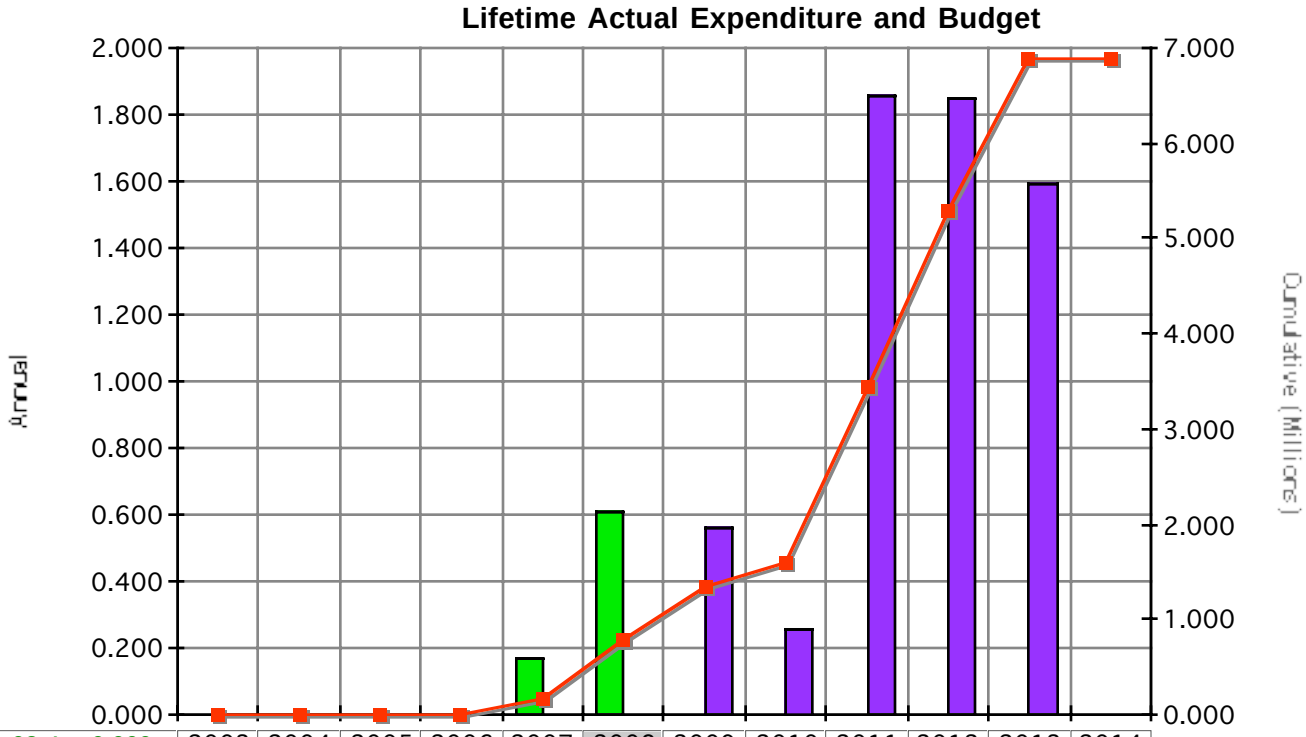
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Barton, Murray, Magnolia, & North Beach Combined Sewer E00022E06	$4,468,869	$0	$4,468,869	$1,545,006	35%	2	$6,013,874	$1,084,691	22	18%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.005	0.016	0.020	0.022	0.326	0.021	0.044	0.015	0.013	0.056	0.013	0.070
Adopted Plan	0.009	0.046	0.053	0.051	0.071	0.060	0.055	0.052	0.057	0.071	0.063	0.140
Cum. Plan	0.009	0.055	0.108	0.159	0.230	0.290	0.345	0.397	0.454	0.588	0.588	0.728
Cum. Act	-0.005	0.011	0.032	0.053	0.379	0.399	0.444	0.459	0.472	0.528	0.541	0.611

Lifetime Cash Flow



Pre-03 Act 0.000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Actual Dec-08					0.170	0.611						
Budget							0.560	0.255	1.853	1.844	1.589	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.170	0.781	1.341	1.596	3.449	5.294	6.882	6.882

RWSP Project Report
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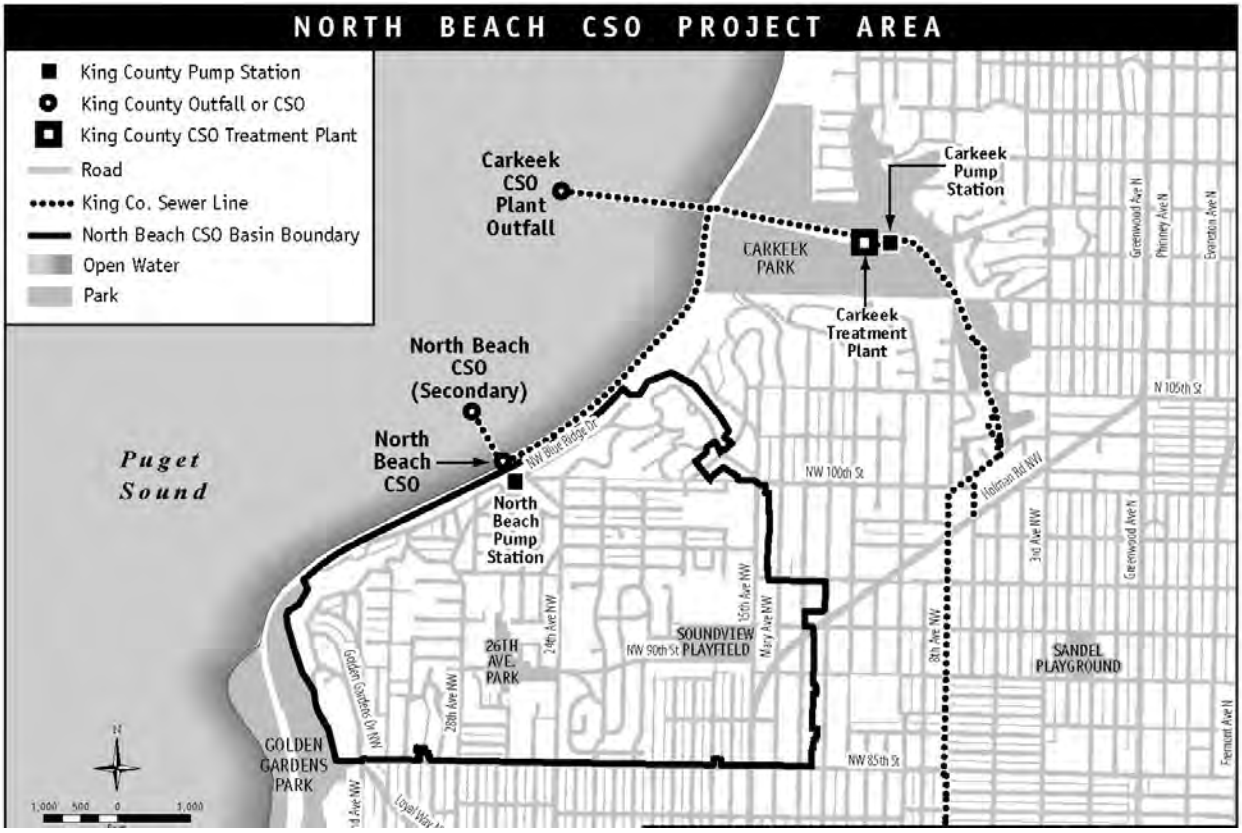
423609 CSO Control & Improvements - North Beach



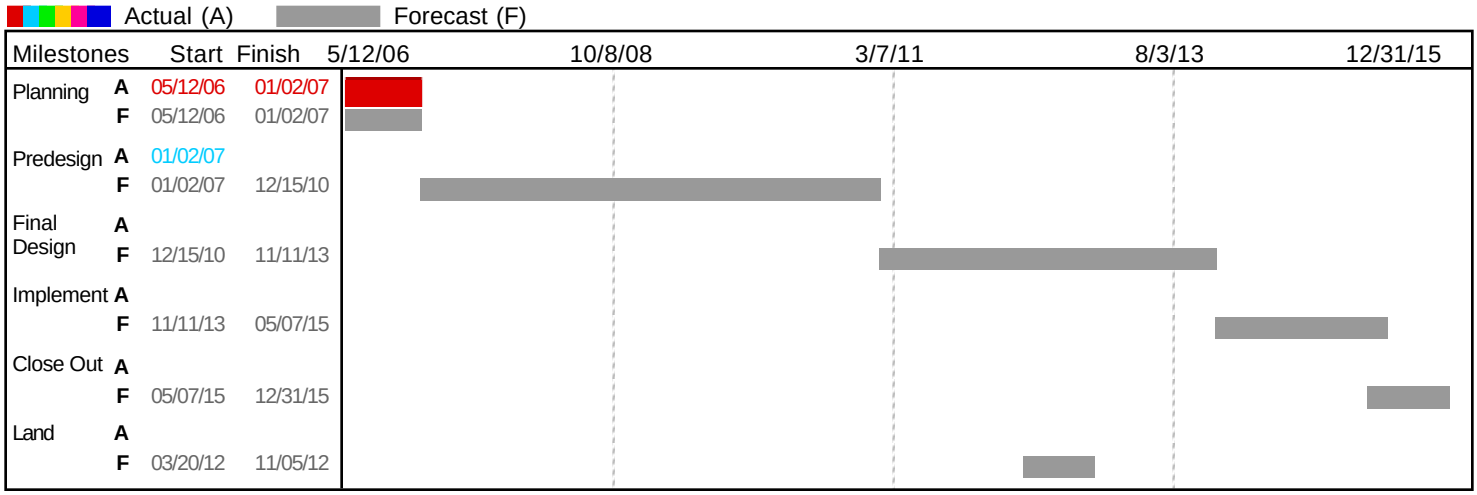
Project Description

This project will design and construct a Combined Sewer Overflow (CSO) control facility and upgrade the North Beach Pump Station to control CSOs to meet state regulations of no more than one CSO per year per location on average.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The project schedule has been extended in order to conduct additional flow monitoring and pump testing to calculate the storage volume needed. This information will be used to evaluate additional project alternatives, including reducing stormwater inflow.

Cost Summary

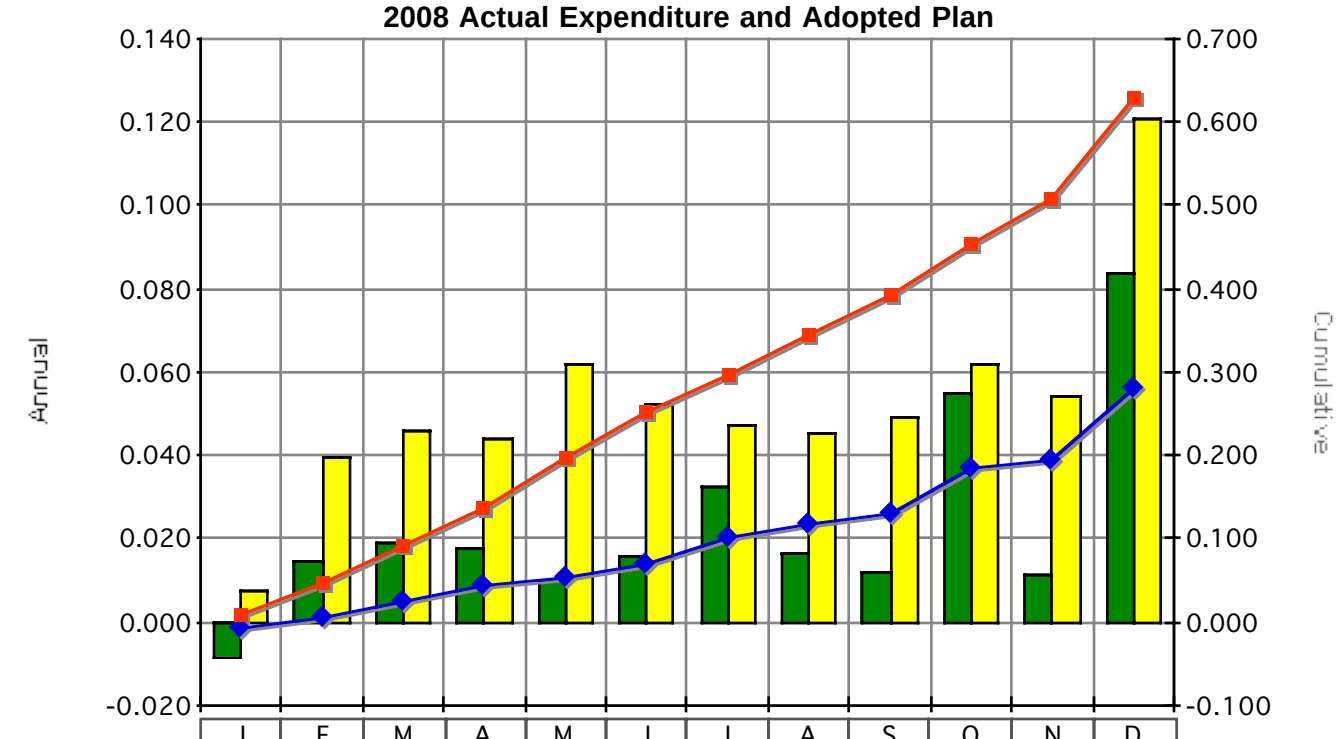
Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	16,449	0	0	16,449	2,880,440	2,534,731
Construction Contracts	3,090	0	0	3,090	2,831,512	2,486,511
Owner Furnished Equipment	13,359	0	0	13,359	0	0
Outside Agency Construction		0	0	0	9	9
Other Capital Charges		0	0	0	48,919	48,211
NON-CONSTRUCTION	263,197	628,848	432,068	453,289	1,937,145	2,291,382
Engineering	106,926	496,456	357,872	203,185	1,006,077	1,354,783
Planning & Management Svcs.	52,179	0	0	52,179	7	7
Permitting & Other Agency Support		0	0	0	32,505	32,505
Right-of-Way		0	0	0	43,617	43,617
Misc. Services & Materials	8,200	0	0	13,114	0	4,915
Staff Labor	95,893	132,392	74,196	184,811	854,940	855,556
PROJECT RESERVE		0	0	0	1,131,443	1,131,443
Project Reserve		0	0	0	1,131,443	1,131,443
Total $	279,646	628,848	432,068	469,738	5,949,028	5,957,557

Cost/Budget Adjustments

Contract Status

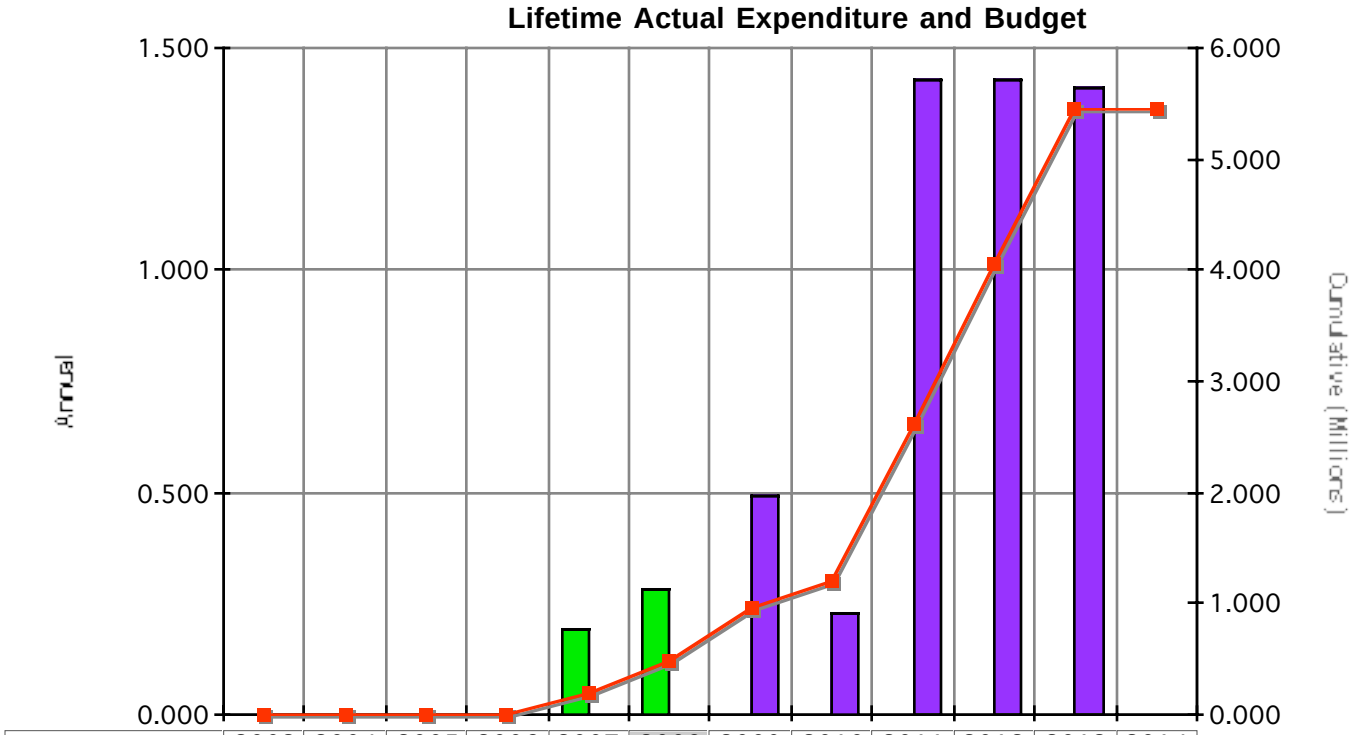
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Barton, Murray, Magnolia, & North Beach Combined Sewer E00022E06	$4,468,869	$0	$4,468,869	$1,545,006	35%	2	$6,013,874	$1,084,691	22	18%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.008	0.014	0.019	0.018	0.010	0.016	0.032	0.017	0.012	0.055	0.011	0.084
Adopted Plan	0.008	0.040	0.046	0.044	0.062	0.052	0.047	0.045	0.049	0.062	0.054	0.121
Cum. Plan	0.008	0.047	0.093	0.137	0.199	0.251	0.298	0.343	0.392	0.508	0.508	0.629
Cum. Act	-0.008	0.006	0.025	0.042	0.053	0.069	0.101	0.117	0.130	0.184	0.196	0.280

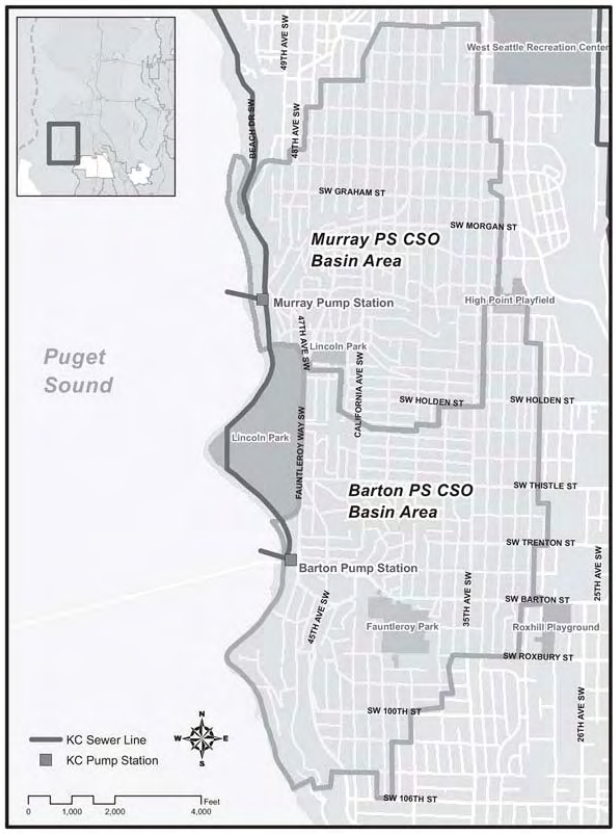
Lifetime Cash Flow



Pre-03 Act 0.000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Actual Dec-08					0.190	0.280						
Budget							0.493	0.228	1.430	1.431	1.409	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.190	0.470	0.963	1.190	2.620	4.051	5.460	5.460

RWSP Project Report
DECEMBER 2008

423610 CSO Control & Improvements - Barton



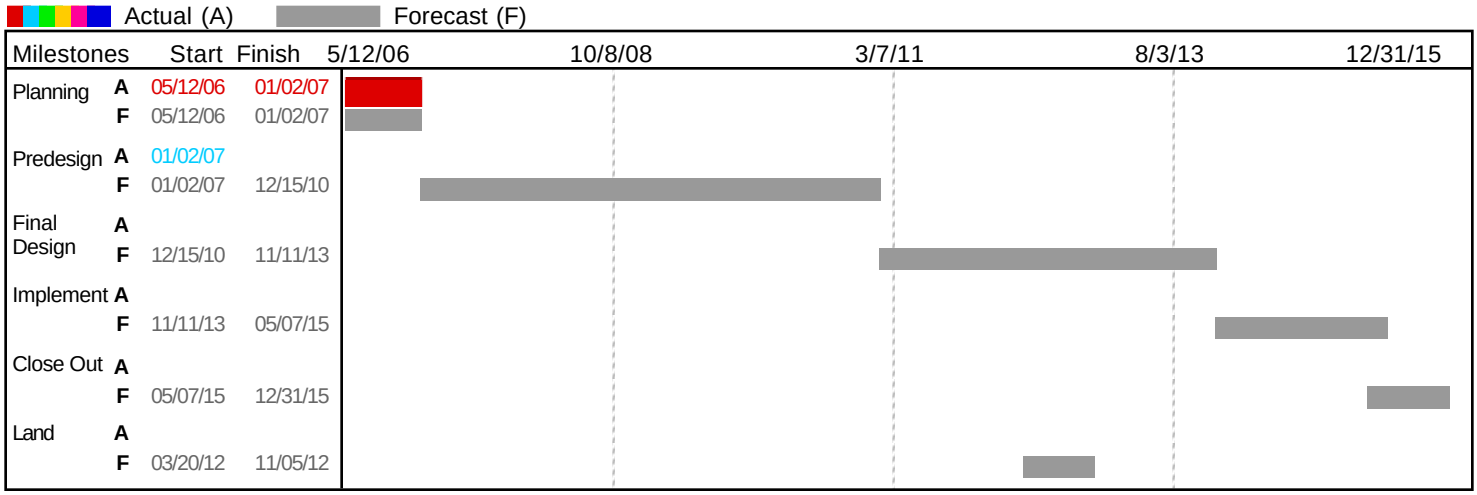
Project Description

This project will design and construct a Combined Sewer Overflow (CSO) control facility to control the CSOs at the Barton Pump Station to meet state regulations of no more than one CSO per year per location on average.

Project Phase: 2 Predesign

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The project schedule has been extended in order to conduct additional flow monitoring and pump testing to calculate the storage volume needed. This information will be used to evaluate additional project alternatives, including reducing stormwater inflow.

Cost Summary

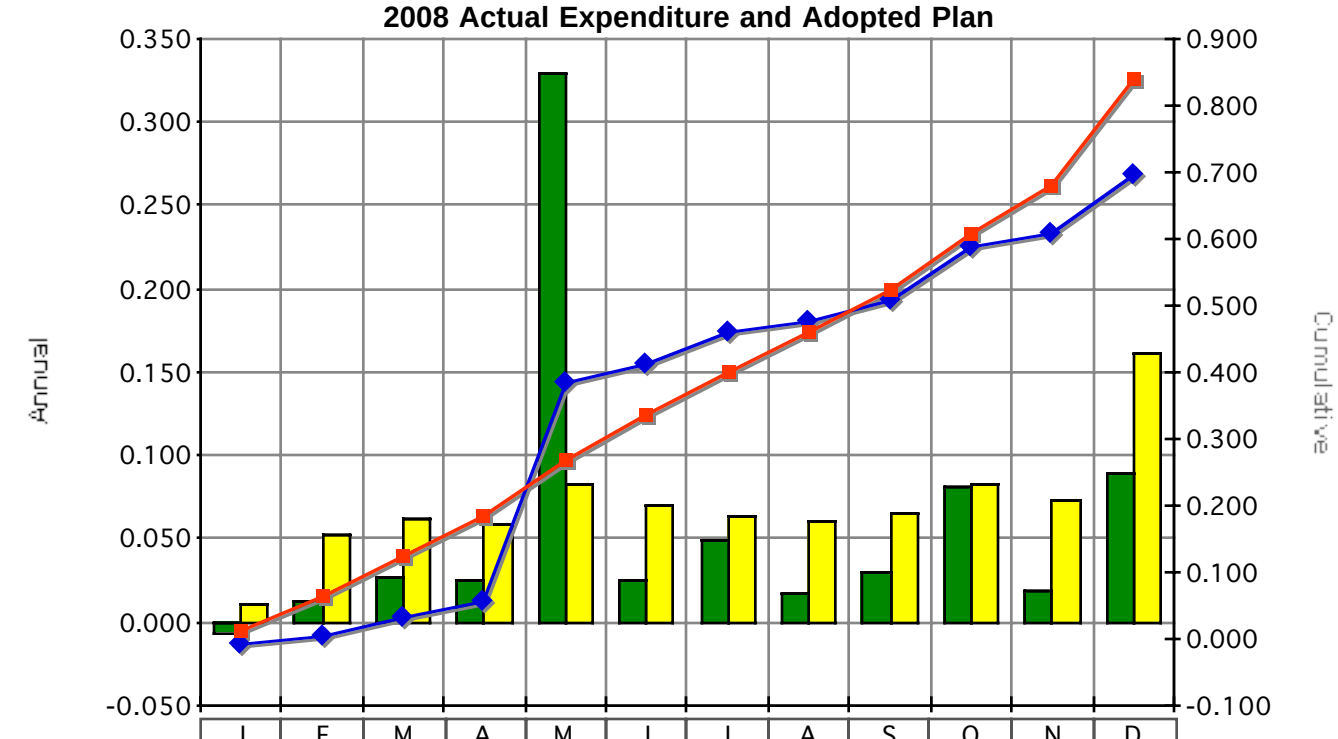
Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	32,117	15,538	10,902	32,117	6,983,861	6,559,532
Construction Contracts	2,679	0	0	2,679	6,821,253	6,399,271
Owner Furnished Equipment	29,437	0	0	29,437	0	0
Outside Agency Construction		0	0	0	9	9
Other Capital Charges		15,538	10,902	0	162,599	160,252
NON-CONSTRUCTION	664,455	826,347	530,600	890,094	3,033,155	3,187,358
Engineering	131,718	643,208	410,046	273,516	1,502,643	1,695,421
Planning & Management Svcs.	48,964	0	0	52,810	4	3,851
Permitting & Other Agency Support	1,256	0	0	1,256	117,441	117,441
Right-of-Way	318,371	0	0	318,371	1,939	1,940
Misc. Services & Materials	8,461	0	0	14,477	0	6,016
Staff Labor	155,686	183,138	120,554	229,665	1,411,127	1,362,689
PROJECT RESERVE		0	0	0	2,750,169	2,750,169
Project Reserve		0	0	0	2,750,169	2,750,169
Total $	696,572	841,884	541,502	922,211	12,767,185	12,497,059

Cost/Budget Adjustments

Contract Status

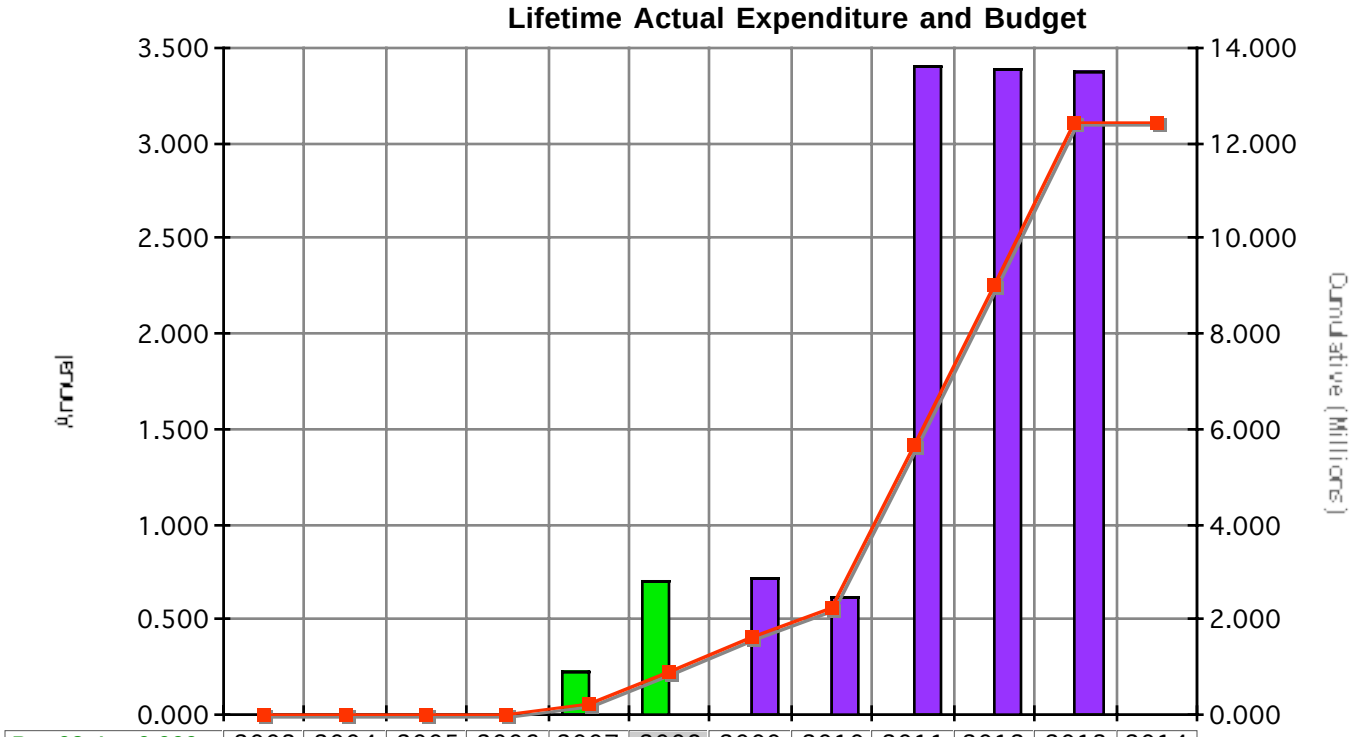
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Barton, Murray, Magnolia, & North Beach Combined Sewer E00022E06	$4,468,869	$0	$4,468,869	$1,545,006	35%	2	$6,013,874	$1,084,691	22	18%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.007	0.012	0.027	0.025	0.328	0.026	0.048	0.017	0.030	0.081	0.019	0.089
Adopted Plan	0.010	0.053	0.061	0.059	0.083	0.070	0.063	0.061	0.066	0.083	0.072	0.162
Cum. Plan	0.010	0.063	0.125	0.184	0.266	0.336	0.399	0.460	0.525	0.680	0.680	0.842
Cum. Act	-0.007	0.005	0.032	0.057	0.386	0.411	0.460	0.477	0.507	0.589	0.608	0.697

Lifetime Cash Flow



Pre-03 Act 0.000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Actual Dec-08					0.226	0.697						
Budget							0.710	0.615	3.399	3.388	3.381	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.226	0.922	1.632	2.246	5.645	9.032	12.41	12.41

RWSP Project Report
DECEMBER 2008

423368 Sediment Managment Plan

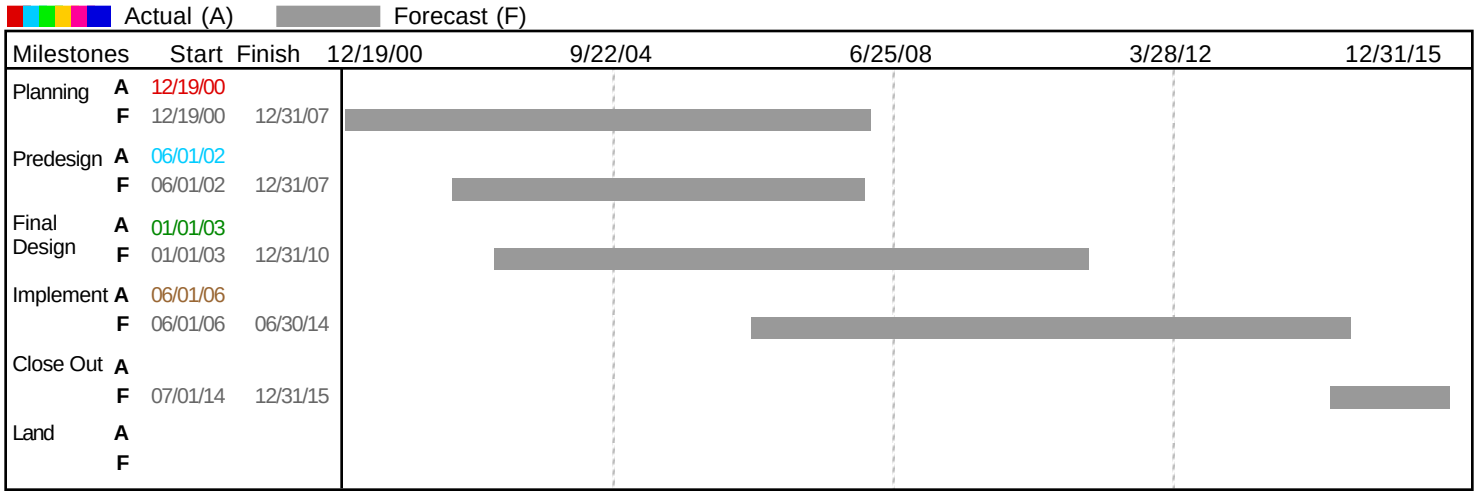
Project Description

This project implements King County's Sediment Management Plan (SMP), which addresses sediment contamination cleanups required under federal Comprehensive Environmental Response, Compensation, and Liability Act and state Model Toxic Control Act regulations. The SMP objectives are to repair potential environmental damage in a timely, efficient and economical process, to prevent harm to public health, and to limit future liability.

Project Phase: 4 Implementation

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule



Schedule Adjustments

The construction schedule for the King, Hanford, and Lander projects has been delayed.

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	1,647,492	1,092,970	2,399,118	3,288,582	30,494,388	32,413,197
Construction Contracts	1,647,492	1,092,970	2,399,118	3,283,170	30,471,172	32,389,981
Owner Furnished Equipment	0	0	0	5,412	5,412	5,412
Other Capital Charges		0	0	0	17,805	17,805
NON-CONSTRUCTION	1,591,114	2,098,177	1,975,619	8,339,956	13,900,935	13,562,026
Engineering	748,111	1,249,918	1,131,729	2,301,198	5,223,553	4,473,512
Planning & Management Svcs.	160,363	0	0	633,550	360,702	473,187
Permitting & Other Agency Support	0	53,045	5,500	96,778	369,467	225,034
Right-of-Way	0		0	2,500		2,500
Misc. Services & Materials	82,695	32,357	28,909	1,785,046	1,801,716	1,828,028
Staff Labor	599,945	762,857	809,482	3,520,885	6,145,497	6,559,764
CREDITS AND REVENUES	-1,486,772	0	0	-1,753,938	-150,639	-267,166
Credits and Revenues	-1,486,772	0	0	-1,753,938	-150,639	-267,166
Total $	1,751,835	3,191,147	4,374,737	9,874,600	44,244,685	45,708,057

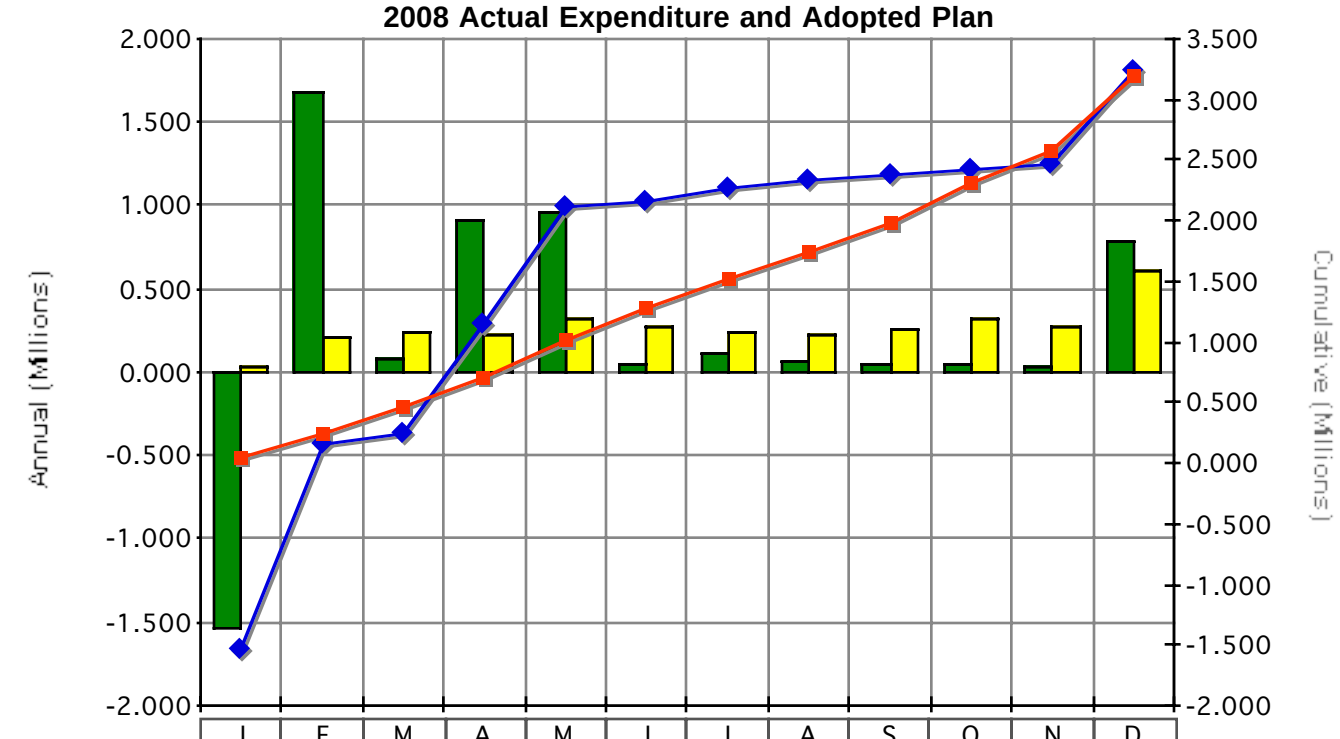
Cost/Budget Adjustments

The increase in lifetime budget costs reflects inflation associated with delaying the start of some projects.

Contract Status

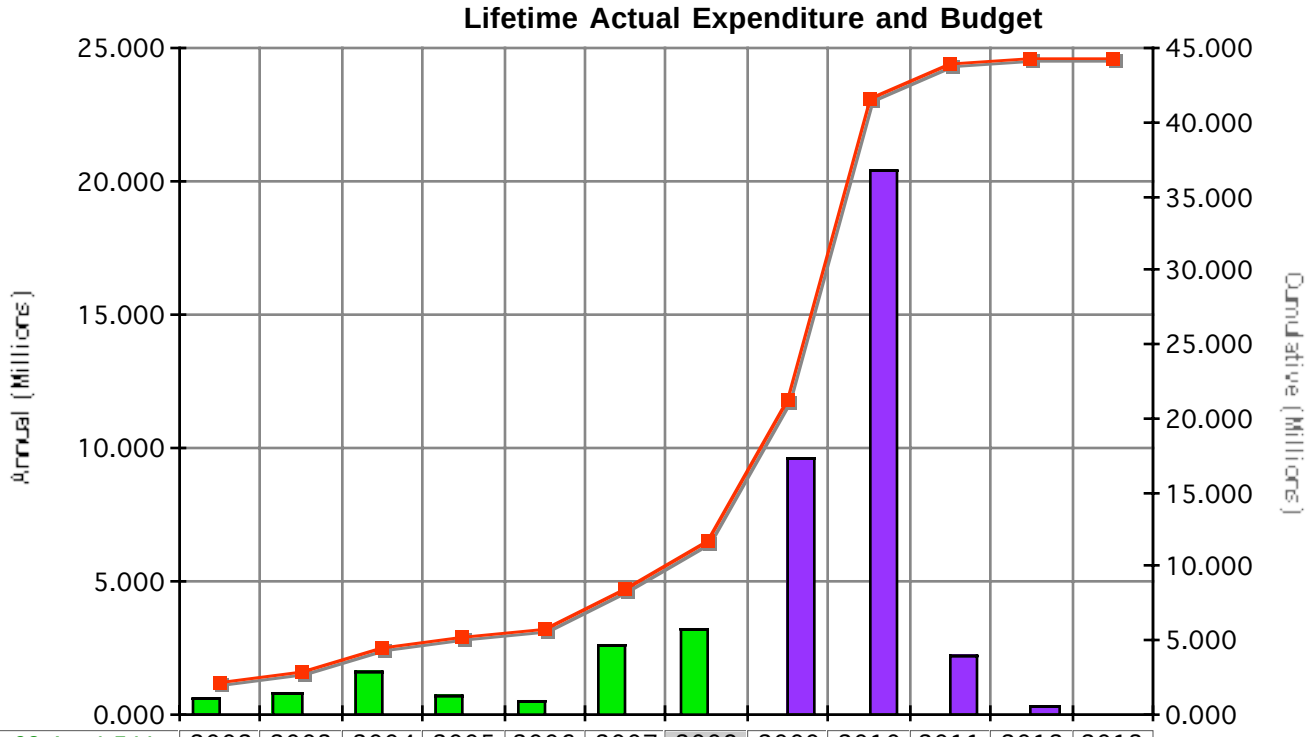
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid
Denny Remediation C00190C07	$3,276,234	$0	$3,276,234	$234,200	7%	1	$3,510,434	$3,013,699	3	86%
Sediment Management P23009P	$526,052	$0	$526,052	$704,947	134%	2	$1,230,999	$671,296	66	55%
Discharge Modeling for Contaminated Sediment P03014P	$53,692	$0	$53,692	$10,136	19%	1	$63,828	$63,383	12	99%

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-1.528	1.681	0.087	0.908	0.962	0.048	0.108	0.065	0.043	0.048	0.039	0.778
Adopted Plan	0.038	0.201	0.233	0.223	0.313	0.265	0.239	0.230	0.249	0.313	0.274	0.613
Cum. Plan	0.038	0.239	0.472	0.696	1.008	1.273	1.513	1.742	1.991	2.578	2.578	3.191
Cum. Act	-1.528	0.152	0.239	1.148	2.110	2.158	2.266	2.331	2.374	2.422	2.460	3.239

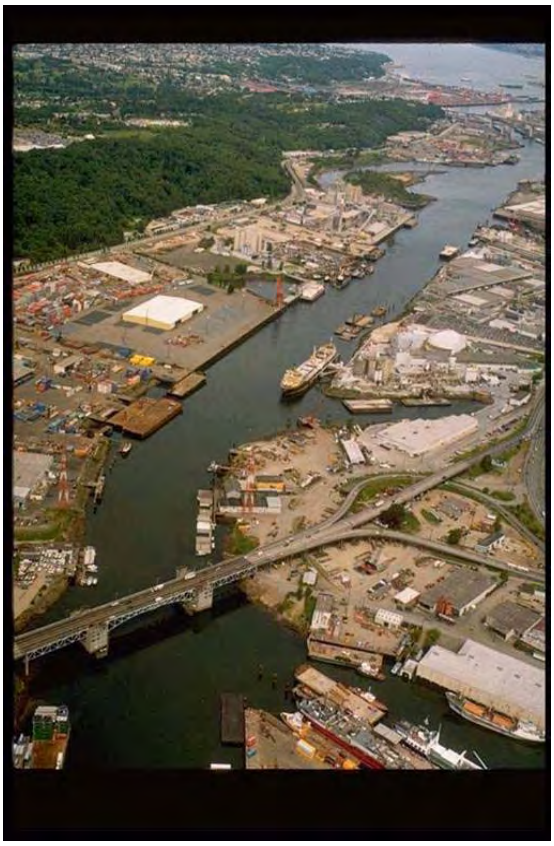
Lifetime Cash Flow



Pre-02 Act 1.544	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Actual Dec-08	0.643	0.771	1.577	0.689	0.524	2.642	3.239					
Budget								9.618	20.41	2.241	0.325	0.000
CumAct+Bdgt	2.186	2.957	4.535	5.224	5.748	8.390	11.62	21.24	41.66	43.90	44.22	44.22

RWSP Project Report
DECEMBER 2008

423589 Lower Duwamish Waterway Superfund



Project Description

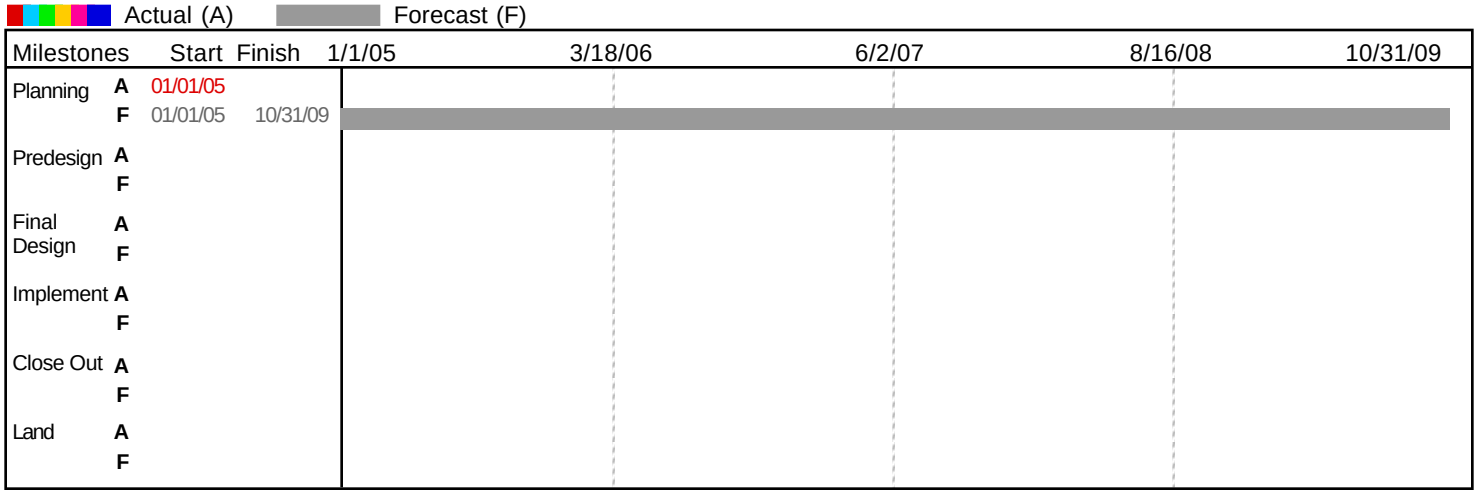
This project implements the county's shared responsibilities under a signed Administrative Order on Consent to conduct a Remedial Investigation/Feasibility Study for the Lower Duwamish Waterway Superfund Site, conduct source control along the waterway, and pay for U.S. Environmental Protection Agency and Washington State Department of Ecology oversight costs.

Project Phase: 1 Development

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Milestone Schedule

Actual (A) Forecast (F)



Schedule Adjustments

Cost Summary

Expenses	2008 Actual Expenditure and Plan			Lifetime Actual Expenditure and Budget		
	IBIS YTD Dec-08	Adopted Plan	Updated Plan	IBIS LTD Dec-08	Lifetime Budget	Updated Budget
CONSTRUCTION	0	0	0	138	0	138
Construction Contracts	0	0	0	138	0	138
NON-CONSTRUCTION	2,020,855	1,066,260	1,152,690	7,228,611	7,043,370	7,290,976
Engineering	545,436	570,302	618,640	634,388	2,206,160	1,153,989
Planning & Management Svcs.	634,215	0	0	1,519,689	365,930	885,474
Permitting & Other Agency Support	0	0	0	386	120	386
Misc. Services & Materials	42,643	51,500	20,000	2,525,781	2,081,609	2,513,438
Staff Labor	798,561	444,457	514,050	2,548,367	2,389,550	2,737,689
CREDITS AND REVENUES	-186,613	0	0	-2,183,760	-1,121,827	-1,997,146
Credits and Revenues	-186,613	0	0	-2,183,760	-1,121,827	-1,997,146
Total $	1,834,242	1,066,260	1,152,690	5,044,989	5,921,542	5,293,968

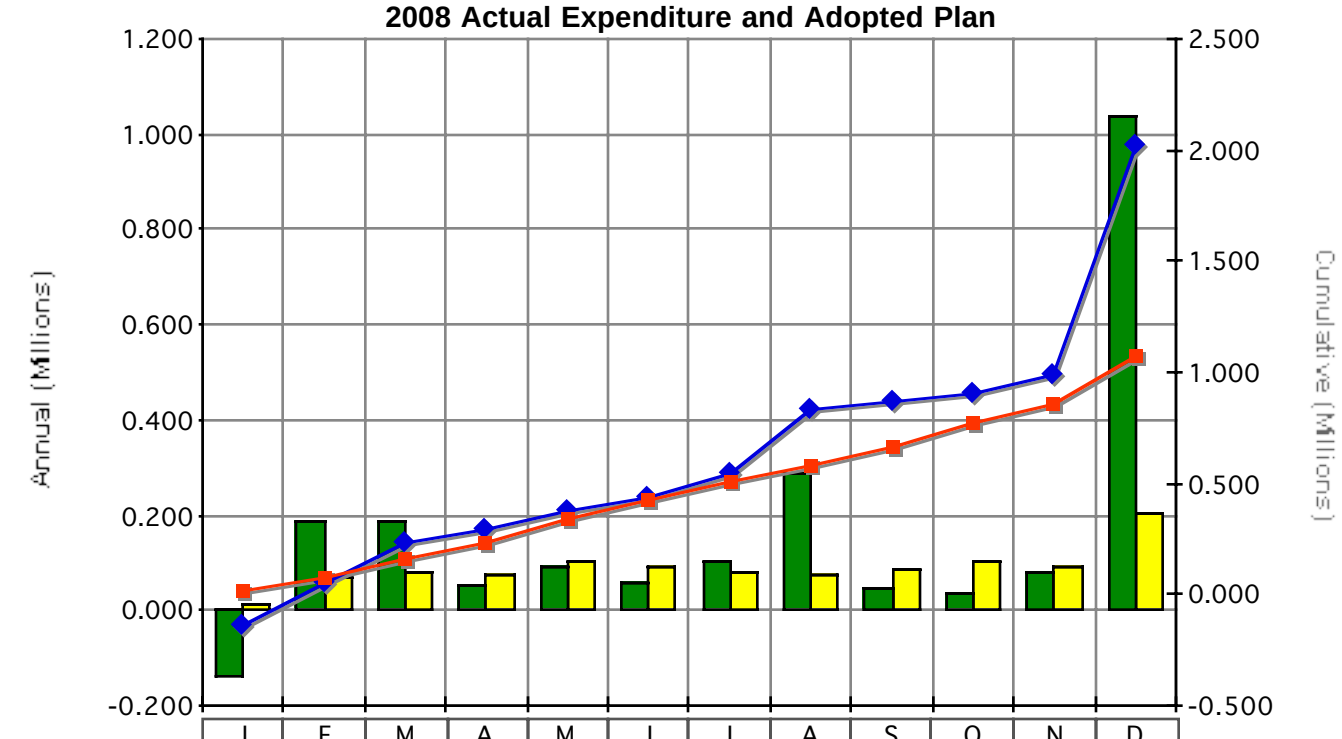
Cost/Budget Adjustments

Additional Model Toxic Control Act grant funding has been secured, which has resulted in the lowering of the lifetime budget estimate.

Contract Status

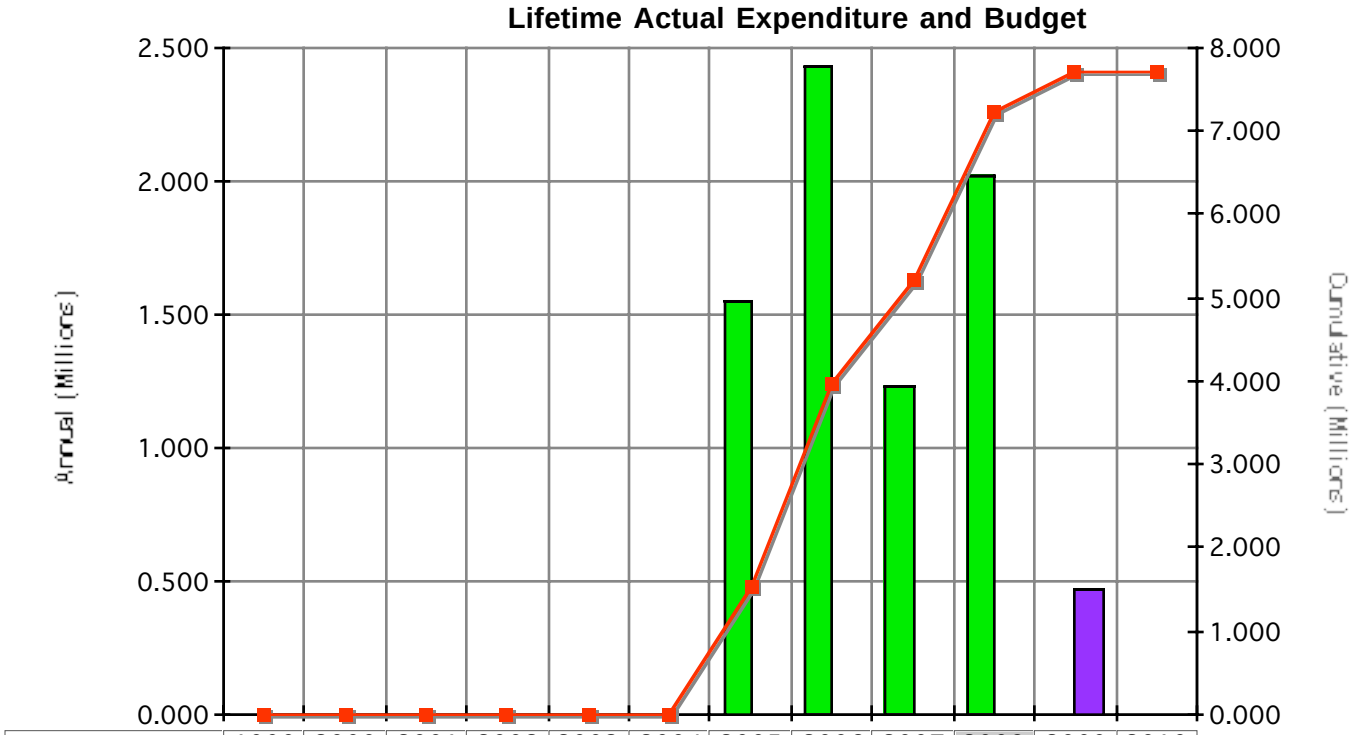
Contract	Original Contract Amount	Phased Amends	Base Contract Amount	Change Amends or COs	Change Percentage	Nbr of Amends/CO's to Date	Current Contract Amount	Amount Paid	Thru Pmt No.	% Paid

Annual Cash Flow



	J	F	M	A	M	J	J	A	S	O	N	D
Actual	-0.140	0.188	0.187	0.053	0.092	0.055	0.102	0.289	0.045	0.036	0.077	1.036
Adopted Plan	0.013	0.067	0.078	0.075	0.104	0.088	0.080	0.077	0.083	0.104	0.092	0.205
Cum. Plan	0.013	0.080	0.158	0.232	0.337	0.425	0.505	0.582	0.665	0.862	0.862	1.066
Cum. Act	-0.140	0.048	0.235	0.288	0.381	0.436	0.538	0.827	0.872	0.908	0.985	2.021

Lifetime Cash Flow



Pre-99 Act 0.000	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Actual Dec-08							1.549	2.429	1.230	2.021		
Budget											0.473	0.000
CumAct+Bdgt	0.000	0.000	0.000	0.000	0.000	0.000	1.549	3.978	5.208	7.229	7.702	7.702

Appendix C

The Health of Our Waters, Water Quality Monitoring Results for 2008

Contents

List of Tables

List of Figures

Acronyms and Abbreviations

BMP	best management practices
C	Centigrade
CFU	colony-forming units
COCs	chemicals of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbon
CSO	combined sewer overflow
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DNR	Washington State Department of Natural Resources
DO	dissolved oxygen
EBDRP	Elliott Bay/Duwamish Restoration Program
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FS	feasibility study
HPA	Hydraulic Permit Approval
LDW	Lower Duwamish Waterway
m	meter
mg/L	milligrams per liter
mL	millileter
nitrate+nitrite	nitrate and nitrite
NPDES	National Pollutant Discharge Elimination System
ORP	oxygen reduction potential
PAHs	polycyclic aromatic hydrocarbons
PAR	photosynthetically active radiation
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
RI/FS	remedial investigation/feasibility study
SAP	sampling and analysis plan
SD	storm drain
SMS	Washington State Sediment Management Standards
SRI	supplemental remedial investigation
SVOCs	semivolatile organic compounds
TOC	total organic compound
TP	total phosphorous
TSI	trophic state index
TSS	total suspended solids
µg/L	micrograms per liter
WAC	Washington Administrative Code
WQI	water quality index
WRIA	Water Resource Inventory Area

This appendix presents a summary of the quality of King County's marine water and freshwater bodies in 2008. The summary is followed by more detailed information on water quality monitoring locations, procedures, and results. The information satisfies the RWSP reporting policies that call for inclusion of yearly water quality monitoring results as a part of the RWSP annual report.

Summary of 2008 Water and Sediment Monitoring

To protect public health and its significant investment in water quality improvements, King County regularly monitors wastewater treatment plant effluent, marine water, fresh water, and sediments (Table C-1 at the end of this summary). The biological, chemical, and physical parameters used to assess a water body's health under Washington State Water Quality Standards are fecal coliform bacteria, dissolved oxygen, temperature, pH, nutrients, turbidity, and a variety of chemical compounds. King County uses other indicators in addition to these parameters.

Some water quality indicators…

Fecal coliform bacteria. The presence of fecal indicator bacteria indicates that the water has been contaminated with the fecal material of humans, birds, or other warm-blooded animals. One type of fecal indicator bacteria, fecal coliforms, may enter the aquatic environment from domestic animals, wildlife, stormwater runoff, wastewater discharges, and failing septic systems. Although these bacteria are usually not harmful, they often occur with other less easily measured disease-causing bacteria and their presence indicates the potential for pathogens to be present and to pose a risk to human health.

Dissolved oxygen. Aquatic plants and animals require a certain amount of dissolved oxygen (DO) for respiration and basic metabolic processes. Waters that contain high amounts of DO are generally considered healthy ecosystems. DO concentrations are most important during the summer season when oxygen-depleting processes are at their peak.

Temperature. Temperature influences many of the chemical components of the water, including DO concentration. Temperature also exerts a direct influence on the biological activity and growth and, therefore, the survival of aquatic organisms. Temperature levels in waters that bear salmonids (cool water fish) are also very important.

Monitoring activities in 2008 found that in general, the quality of marine and fresh waters in King County is fair to good.

Treatment Plant Effluent

King County regularly samples wastewater effluent from its four secondary wastewater treatment plants—West Point, South, Vashon, and Carnation plants—and analyzes these samples at process laboratories at the plants and at its environmental laboratory in Seattle. Three plants discharge their effluent into Puget Sound through deep outfalls. Carnation discharged to the Snoqualmie River in 2008 and will start discharging to a nearby wetland in 2009. Discharges continue to be in compliance with the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) permit for each plant, and so are in compliance with the Washington State Water Pollution Control Law, the Federal Water Pollution Control Act, and the Federal Clean Water Act.

Marine Water and Sediment

King County's Puget Sound Marine Monitoring Program routinely collects and analyzes water samples at the following locations: (1) near treatment plant and Combined Sewer Overflow

(CSO) outfalls to assess potential effects to Puget Sound water quality from wastewater discharges; (2) at ambient locations in the Sound to better understand regional water quality and to provide data needed to identify trends that might indicate impacts from long-term cumulative pollution; and (3) at Puget Sound beaches, including beaches near outfalls.[1] It also collects sediment samples near outfalls and at ambient locations in Elliott Bay and the Central Basin of Puget Sound.

Offshore and Nearshore Water

Seventeen stations in the offshore and nearshore water column were monitored monthly in 2008. Fifteen of the seventeen stations were monitored for nutrients, fecal indicator bacteria, dissolved oxygen (DO), turbidity, temperature, salinity, chlorophyll, water clarity, suspended solids, and photosynthetically active radiation (PAR).[2] Two of the stations were monitored for nutrients, fecal indicator bacteria, temperature, and salinity. In addition, two continuous water quality monitoring systems at two locations (along the Seattle waterfront and in Quartermaster Harbor near Vashon–Maury Island) collect temperature, salinity, DO, turbidity, chlorophyll, and pH data every 15 minutes. These continuous data systems are augmenting and aiding in the interpretation of the monthly data collected at the other offshore sites.

Water quality in Puget Sound is evaluated by two fecal coliform bacteria standards—the geometric mean and the peak. All offshore marine monitoring locations—both ambient and outfall locations—met these fecal coliform bacteria standards in 2008. One nearshore station in Elliott Bay along the Seattle waterfront and another nearshore station at the mouth of the Lake Washington Ship Canal did not meet all fecal coliform bacteria standards, although they showed steady improvement as the year progressed. Both stations are near freshwater bacteria sources such as storm drains and the mouths of streams and creeks.

The overall quality of offshore marine waters is evaluated through the water quality index (WQI). Results of 2008 monitoring indicate that overall water quality in Puget Sound is good. The 14 offshore sites, including the 7 outfall sites, for which the WQI is calculated were classified as having good water quality (low level of concern).

Marine Beach Water

Twenty-five beach stations were monitored in 2008 for fecal indicator bacteria, nutrients, temperature, and salinity. One stream site, located in Piper's Creek, was monitored for fecal coliform bacteria and nutrients because this site affects water quality at the outflow on the beach at Carkeek Park. Fourteen of the twenty-five monitoring locations met all fecal coliform bacteria standards. Six stations did not meet any of the standards. These stations are near freshwater sources containing animal wastes, including streams and CSO, non–King County treatment plants, and stormwater outfalls.

[1] Ambient monitoring measures surrounding (background) conditions.

[2] Photosynthetically active radiation is the portion of the electromagnetic spectrum associated with photosynthesis. Its measure is important in evaluating the effect of light on plant growth.

Sediment

Sediments in ambient locations in Elliott Bay are sampled every two years and the Central Basin of Puget Sound every five years. All stations were sampled in 2007. The sampling found that sediment quality in these areas is generally good, with some isolated impacts from human activity. Sediment sampling near the West Point Treatment Plant outfall, also done in 2007, indicated that sediment quality was intermediate to high quality in all stations sampled.

Lake Water and Sediment

The Major Lakes Monitoring Program has been sampling 25 open-water (mid-lake) and nearshore sites in Lakes Washington, Sammamish, and Union (including the Lake Washington Ship Canal) since the early 1970s; the Swimming Beach Monitoring Program has been sampling 17 beaches on Lake Sammamish, Lake Washington, and Green Lake every summer since 1996; and in 2007, the Major Lakes Sediment Monitoring Program started a 10-year program to monitor sediment quality in Lakes Washington, Sammamish, and Union.

Mid-Lake and Nearshore Water

Open-water and nearshore stations were sampled biweekly in the summer and monthly during the rest of 2008 for temperature, DO, pH, conductivity, clarity (Secchi transparency), nutrients, and fecal coliform bacteria.

Ambient water quality, as indicated by fecal coliform bacteria levels, is generally good. In 2008, 100 percent of the stations in the three lakes achieved the exceptionally high standard used to assess ambient lake water. This is an improvement from 2007 when some stations in Lake Union and Lake Washington did not meet the standards. In 2008, routine sampling events preceeded major storms and, thus, stormwater was less influential.

Summer phosphorus concentrations are converted to a trophic state index to assess overall water quality in Lakes Washington, Sammamish, and Union. The 1994–2008 results for Lakes Sammamish and Washington show that phosphorus concentrations fluctuated between the low and moderate thresholds from year to year, indicating that the water quality varies from good to moderate with low potential for nuisance algal blooms (algae feeds on phosphorus). Lake Union typically shows phosphorus concentrations in the moderate water quality range, with the exception of 2007. In 2007, high phosphorus levels placed Lake Union in the poor water quality range. High phosphorus concentrations in urbanized areas can result from poorly designed drainage systems, inadequate maintenance of sewer infrastructure, and home and business landscaping practices.

Swimming Beach Water

Monitoring results from 2008 show that the higher concentrations of fecal coliform bacteria occur at beaches adjacent to streams that drain urbanized drainage basins. Bacteria levels were low in Green Lake for the sixth year in a row (all samples met the standard). Lake Sammamish levels remain consistently low, with slight variability from year to year. High bacteria levels resulted in the closure of one beach on Lake Washington (Juanita) in 2008. High bacteria levels were noted at Magnuson off-leash area, Gene Coulon, Mathews, and Luther Burbank swimming beaches, but the levels did not exceed standards. Intensive bacteria monitoring took place in the

Juanita Creek basin in 2008 as a joint effort between King County, the City of Kirkland, and the Washington State Department of Ecology. Results of the effort will be published in 2009.

Sediment

Sediments at five stations are monitored in deep areas of Lakes Washington, Sammamish, and Union each year for trends. Other stations are sampled to investigate sediment quality in swimming beaches, nearshore habitat, and in areas with known contamination. Samples are analyzed for metals, organics, and physical parameters. In 2008, samples were collected in Lake Washington. The results are still being analyzed. Results from 2007 sampling in Lake Sammamish indicate that 10 out of 18 stations showed chemical concentrations high enough to suggest likely adverse effects to aquatic organisms.

Stream and River Water and Sediment

The Stream and River Monitoring Program targets rivers and streams that cross sewer trunk lines and those that are considered a potential source of pollutant loading to a major water body. This long-term program has collected samples at 63 sites on four rivers and twenty-eight streams for many years.[3] Overall water quality of rivers and streams in King County, as measured by the WQI for rivers and streams, varies between and within streams. Increased urbanization has resulted in more surface runoff and changes to peak streamflow that cause flooding, channel erosion, and increased contaminant loading.

In 2008, theWQI indicated that 81 percent of the sixty-three sampling sites—compared to 80 percent in 2007—were of moderate or high water quality concern (poor to moderate water quality) and 19 percent were rated of low concern (good water quality). All sites rated of high concern were affected in part by excessive nitrogen and/or phosphorus. In addition, almost all high-concern sites were affected by low DO (73 percent of all sites), high fecal coliform bacteria (67 percent of all sites), high temperatures (33 percent of all sites), and high suspended solids/turbidity (13 percent of all sites).

The Streams Sediment Monitoring Program monitors sediment in small wadeable streams in Water Resource Inventory Areas (WRIAs) 8 and 9.[4] Samples are collected at one location in 10 index creeks each year and analyzed for trends. In addition, one-time samples are collected every creek-mile in approximately three stream basins each year. All 30 streams in the program will be monitored within 10 years. Samples are analyzed for metals, organics, and physical parameters. So far, 13 streams in WRIA 8 have been sampled. Results suggest that there are likely adverse effects to aquatic organisms from chemicals at 32 of the sites that were monitored.

[3] Starting in 2009, the number of stream and river sites to be monitored will drop to 20 because of budget cuts.
[4] The two major watersheds—called Water Resource Inventory Areas (WRIAs)—in King County are the Lake Washington/Cedar/Sammamish watershed (WRIA 8) and the Green/Duwamish and Central Puget Sound watershed (WRIA 9).

Other Monitoring

In addition to ongoing water and sediment quality monitoring, the county conducts special intensive investigations. Examples include the following:

- Studies are under way to support decision-making, siting, and construction of wastewater capital projects. For example, the wetland that will receive effluent from the new Carnation Treatment Plant is being monitored both before plant startup to establish a baseline and after discharge begins to monitor for any trends in water and sediment quality.
- In 2008, King County was awarded a grant by the U.S. Environmental Protection Agency (EPA) to conduct the Quartermaster Harbor Nitrogen Management Study. The study, prompted by low DO levels and other indicators of degraded water quality, will begin in 2008 and extend through 2012.
- King County is participating in studies, some of them under the federal Superfund program, of sediments contaminated from historical discharges from CSO and storm drain outfalls.

Availability of Monitoring Data on the Web

In 2008, King County's regional data management program continued to maintain and upgrade the methods used to store and disseminate monitoring data so that the public can directly download substantial amounts of data from the Web:

- The Puget Sound Marine Monitoring Program page provides tables and graphs of measurements of Puget Sound water quality collected from the surface to the bottom. This page was upgraded in 2007 to provide data for continuous water quality meters in Elliott Bay and Quartermaster Harbor. It is currently being updated so that all data will be available for viewing and downloading. The updated page is expected to be completed in 2010. The page is found at http://green.kingcounty.gov/marine/HiFrequency.aspx.
- The Swimming Beach Monitoring Program page provides tables, graphs, and maps of monitoring results as they become available each week and provides the most current information on beach closures. The page is found at http://green.kingcounty.gov/swimbeach/.
- The Major Lakes Monitoring Program page (http://green.kingcounty.gov/lakes/) and the Stream and River Monitoring Program page (http://green.kingcounty.gov/WLR/Waterres/StreamsData/) provide tables and graphs of monitoring results as they become available each month. These pages continue to allow for direct data download from the Web. A substantial upgrade to the Stream and River monitoring page was released in May 2008.
- The Hydrologic Information Center page provides the public with access and robust ability to download rainfall, streamflow, water quality, and other hydrologic data collected at King County gauge sites. It also offers a summary of the year's precipitation

and provides access to presentations made by King County's hydrology staff. The page is found at http://green.kingcounty.gov/wlr/waterres/hydrology/.

- The Lakes Stewardship Program page was upgraded to provide the ability to download data and to access graphs and maps of the lakes and the monitoring data. The page is found at http://www.kingcounty.gov/environment/wlr/lake-stewardship-program.aspx.

Table C-1. Summary of King County Water Quality Monitoring Programs

Program	Media and Locations	Parameters	Methods	Sampling Frequency	Program Purpose	Duration
Ongoing Monitoring						
Marine monitoring	Water and sediment in areas of Puget Sound near and away from treatment plant and CSO outfalls Water and shellfish (butter clams) at Puget Sound beaches	Water: temperature, salinity, clarity, DO, TSS, turbidity, nutrients, pH, chlorophyll, PAR, and bacteria Ambient sediment: metals, organics, and physical properties Beach water: temperature, salinity, nutrients, and bacteria Shellfish: lipids and metals	Water samples collected at multiple depths, ranging from 1 to 200 m Sediment: VanVeen grab sampler for subtidal sediments; sediment corer for intertidal sediments[a] Shellfish: shovel	Water: monthly; continuous (every 15 minutes) at 2 sites Sediment: every 2 years (Elliott Bay), every 5 years (Puget Sound) Shellfish: semi-annually	To assess potential effects to water quality from point and nonpoint pollution sources and to compare quality to county wastewater sources	Ongoing
Marine NPDES sediment monitoring	Sediments in Puget Sound near treatment plant outfalls	Grain size, solids, sulfides, ammonia-nitrogen, oil & grease, TOC, metals, organic compounds, and (at South and West Point plants) benthic infauna	Sediment samples in a grid pattern as defined in the SAP approved by Ecology	Sediment samples at outfalls once per permit cycle (about every 5 years)	NPDES permit requirement	Ongoing
Major lakes monitoring	Water and sediment in Lakes Washington, Sammamish, and Union at ambient locations and near stormdrains and CSOs	Water: temperature, DO, pH, conductivity, clarity, nutrients, and fecal coliform; micorcystin at select stations Sediment: metals, organics, and physical properties	Water samples collected every 5 m from 1 m below the surface to bottom at one station in center of lake and from the surface around various locations around the shoreline Sediment: surface, petite ponar[b]	Water samples: biweekly during the growing season; monthly during the rest of the year Sediment: yearly	To identify impacts from the wastewater conveyance system and to document the condition of lakes	Ongoing

BMP = best management practices; CSO = combined sewer overflow; DNR = Washington State Department of Natural Resources; DO = dissolved oxygen; Ecology = Washington State Department of Ecology; EPA = U.S. Environmental Protection Agency; HPA = Hydraulic Permit Approval; m = meter; NPDES = National Pollutant Discharge Elimination System; ORP = oxygen reduction potential; PAR = photosynthetically active radiation; SAP = sampling and analysis plan; TOC = total organic carbon; TSS = total suspended solids.

[a] Intertidal zone is the area that is exposed to the air at low tide and submerged at high tide; subtidal zone is the area below the intertidal zone that is always covered by water.

[b] Petite ponar is a type of grab sampler that can easily be carried by one person in the field and can be deployed without the use of a winch or crane recommended for larger samplers.

Table C-1. Summary of King County Water Quality Monitoring Programs

Program	Media and Locations	Parameters	Methods	Sampling Frequency	Program Purpose	Duration
Swimming beach monitoring	Lake Washington, Lake Sammamish, and Green Lake	Bacteria and microcystin (algal toxin)	Water samples at swimming beaches	Weekly, in the summer from Memorial Day through end of September	To evaluate human health risks and necessity for beach closures	Ongoing
Small lakes monitoring	Volunteers monitor 44 small lakes in King County	Precipitation, lake level, temperature, Secchi depth, phosphorus, nitrogen, chlorophyl-a, phytoplankton	Single-point and vertical profiles	Rainfall & lake level: daily Temperature & Secchi depth: weekly Other parameters: every 2 weeks April to October	To characterize and identify trends in water quality	Ongoing
Rivers and streams monitoring	Water quality samples from rivers and streams of both watersheds; emphasis on wadeable streams that cross wastewater conveyance lines or that could be a source of pollution Stream sediment samples for trends analysis at 10 sites, plus spatial analysis of stations every creek mile Streamflow and temperature data from 35 stream locations	Baseflow and storm samples: turbidity, TSS, pH, temperature, conductivity, DO, nutrients, ammonia, bacteria Storm samples: trace metals Sediment: metals, organics, and physical parameters	Various methods for collecting water samples Sediment: surface sediments, core tube, petite ponar Streamflow and temperature: continuous data recorders; direct measurements 6–12 times per year	Monthly sampling under baseflow conditions; 3–6 times per year at mouth of streams under storm conditions Sediment: yearly	To identify impacts from the wastewater conveyance system, to document the condition of streams and rivers, to identify long-term trends	Ongoing

BMP = best management practices; CSO = combined sewer overflow; DNR = Washington State Department of Natural Resources; DO = dissolved oxygen; Ecology = Washington State Department of Ecology; EPA = U.S. Environmental Protection Agency; HPA = Hydraulic Permit Approval; m = meter; NPDES = National Pollutant Discharge Elimination System; ORP = oxygen reduction potential; PAR = photosynthetically active radiation; SAP = sampling and analysis plan; TOC = total organic carbon; TSS = total suspended solids.

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[b] Petite ponar is a type of grab sampler that can easily be carried by one person in the field and can be deployed without the use of a winch or crane recommended for larger samplers.

Table C-1. Summary of King County Water Quality Monitoring Programs

Program	Media and Locations	Parameters	Methods	Sampling Frequency	Program Purpose	Duration
Benthic macroinvertebrate monitoring	Wadeable stream sub-basins	Size and distribution of aquatic macroinvertebrate populations	Samples colllected with a Surber stream bottom sampler	Annually	To establish a baseline for identifying long-term trends	Ongoing
Precipitation monitoring	Rainfall measured at 70 locations in King and Snohomish Counties, and at 2 meteorologic stations	Rainfall, air temperature, wind pressure, calculated transpiration/evaporarion	Continuous data recorders		To analyze infiltration to wastewater conveyance system and to model stormwater	Ongoing
Special Studies						
Brightwater Outfall Studies	Water, sediment, eelgrass, and intertidal biota for the Brightwater outfall site	Water: temperature, salinity, clarity, DO, nutrients, suspended solids, turbidity, chlorophyll, PAR, and bacteria Sediment: chemistry and benthic taxonomy Eelgrass and intertidal biota: distribution and relative abundance	Water column samples collected at multiple depths, from 1 to 175 m Surface sediments collected by grab sampling Eelgrass survey: side-scan sonar, underwater video, SCUBA divers Intertidal biota survey: transect/quadrat method	Water: monthly Sediment: 4 times per year Eelgrass: 7 sampling events over the course of the study Intertidal biota: annually for 5 years	To meet HPA and DNR outfall lease requirements and to compare outfall pre-construction to post-construction data	Through 2014
Brightwater Construction NPDES Stormwater Monitoring	Stormwater and surface water	Stormwater quality	Various	Intensive	To meet NPDES Construction Stormwater permit	Through 2010

BMP = best management practices; CSO = combined sewer overflow; DNR = Washington State Department of Natural Resources; DO = dissolved oxygen; Ecology = Washington State Department of Ecology; EPA = U.S. Environmental Protection Agency; HPA = Hydraulic Permit Approval; m = meter; NPDES = National Pollutant Discharge Elimination System; ORP = oxygen reduction potential; PAR = photosynthetically active radiation; SAP = sampling and analysis plan; TOC = total organic carbon; TSS = total suspended solids.

[a] Intertidal zone is the area that is exposed to the air at low tide and submerged at high tide; subtidal zone is the area below the intertidal zone that is always covered by water.

[b] Petite ponar is a type of grab sampler that can easily be carried by one person in the field and can be deployed without the use of a winch or crane recommended for larger samplers.

Table C-1. Summary of King County Water Quality Monitoring Programs

Program	Media and Locations	Parameters	Methods	Sampling Frequency	Program Purpose	Duration
Elliott West/Denny Way CSO sediment monitoring	Sediment near the new Denny Way Regulator and Elliott West CSO Treatment Facility outfalls and in sediment cleanup areas associated with the old Denny Way CSO discharge site	Benthic communities, sediment chemistry	Sediment samples per approved SAP	Variable	To meet U.S. Army Corps of Engineers permit requirements and an Ecology cleanup order	Through 2021
Duwamish/Diagonal post-remediation sediment monitoring	Sediment near the Seattle Diagonal storm drain (includes city and county CSO outfalls) and the county's Duwamish CSO outfall	Sediment chemistry, turbidity, cap surveys	Sediment samples per approved SAP	Annual	Under an EPA/Ecology Consent Order	Through 2013
Wetland monitoring for Carnation Treatment Plant	Water quality in discharge wetland, existing tributaries, and outflow Sediment quality in wetland pond	Water: metals, organics, nutrients, bacteria Sediment: metals, organics, and physical parameters	Water column Surface sediments	Variable	Determine conditions before and after treatment plant discharge	2006–2010
Quartermaster Harbor Nitrogen Management Study	Groundwater quality Streamwater quality Streamflow and temperature (done as part of another project) Marine water quality (see ambient marine monitoring above)	Groundwater: alkalinity, nutrients, TSS, bacteria, DO, pH, specific conductance, temperature, turbidity, oxidation reduction potential Streamwater: same as groundwater, except for addition of mircrobiology and deletion of TSS and ORP	Groundwater: monitoring wells with dedicated sampling equipment Streamwater: various sampling methods	Groundwater: Annually Streams: Monthly Streamflow: continuously at 5 sites; every 2 years at 22 sites	Recommend policy changes for nitrogen management in the King County Comprehensive Plan	2009–2012

BMP = best management practices; CSO = combined sewer overflow; DNR = Washington State Department of Natural Resources; DO = dissolved oxygen; Ecology = Washington State Department of Ecology; EPA = U.S. Environmental Protection Agency; HPA = Hydraulic Permit Approval; m = meter; NPDES = National Pollutant Discharge Elimination System; ORP = oxygen reduction potential; PAR = photosynthetically active radiation; SAP = sampling and analysis plan; TOC = total organic carbon; TSS = total suspended solids.

[a] Intertidal zone is the area that is exposed to the air at low tide and submerged at high tide; subtidal zone is the area below the intertidal zone that is always covered by water.

[b] Petite ponar is a type of grab sampler that can easily be carried by one person in the field and can be deployed without the use of a winch or crane recommended for larger samplers.

Marine Water Monitoring Results

This section presents key findings of monitoring of offshore, nearshore, and beach waters of Puget Sound in 2008. It also presents the objectives of a study of Quartermaster Harbor that will begin in 2009 and that was initiated based on results of routine monitoring.

Ambient and Outfall Locations in the Offshore and Nearshore Water Column

Figure C-1 shows both ambient and outfall water quality monitoring stations in Puget Sound. Ambient stations are monitored to gauge general environmental conditions; outfall monitoring stations are located near King County wastewater treatment plant and CSO outfalls. These 17 stations were the same stations that were sampled in 2007. They include 13 offshore stations (6 ambient and 7 outfall) that were sampled by boat and 4 nearshore stations that were sampled from docks. The four nearshore stations are the central Seattle waterfront near Pier 48, Shilshole Bay south of the marina, and two stations in Quartermaster Harbor near Vashon Island. Between one and seven samples are collected at each station; the total number of samples depends on the depth at the station.

This section describes the results of marine monitoring activities in 2008 in terms of fecal coliform bacteria levels and overall water quality rankings (water quality index). In addition, this section presents 2005–2008 data from the measurement of individual parameters—DO, chlorophyll-*a*, and ammonia. Although DO and ammonia values are included in the WQI calculation, these parameters are important indicators of water quality (along with the many other parameters measured), and it is useful to discuss them separately. Information on general patterns and cycles was taken from a report that King County published in April 2008 titled *Water Quality Status Report for Marine Waters, 2005–2007.* This report and past water quality reports provide a detailed discussion of all marine water quality monitoring results. They can be found at http://green.kingcounty.gov/marine/Reports.aspx.

Fecal Coliform Bacteria

Levels of fecal coliform bacteria at 17 offshore and nearshore Puget Sound locations were measured monthly in 2008 to gauge the risk posed to human health from recreational uses of these waters. At outfall stations, fecal coliform samples were collected at the surface and at multiple additional depths. At ambient stations, fecal colifrom sample were collected only at the surface.

For marine surface waters, two fecal coliform standards are used: (1) a geometric mean standard of 14 colony-forming units (CFU) per 100 millileters (mL) and (2) a peak standard that specifies that no more than 10 percent of the samples used to calculate the geometric mean exceeds 43 CFU/100 mL.[5] The peak standard is evaluated on an annual basis. If fecal coliform counts in two or more samples collected during 2008 were greater than 43 CFU/100 mL, then the station

[5] A colony-forming unit (CFU) is a measure of viable bacterial numbers. Unlike in direct microscopic counts where all cells, dead and living, are counted, CFU measures only viable cells.

failed the peak standard. For the geometric mean standard, the period of averaging should not exceed 12 months. Because samples were collected monthly, a total of 11 or 12 samples was used in 2008 to calculate the geometric mean. Two geometric means were evaluated for each station:

- An annual geometric mean was calculated using the monthly data collected from January through December 2008 at each station. This annual geometric mean provides a picture of the overall bacterial water quality for 2008.
- To take a closer look at bacterial water quality on a month-to-month basis, a "running" geometric mean was calculated for each station. The running geometric mean takes the bacteria data for each month, along with its previous 11 months of data, to calculate a monthly geometric mean.

In 2008, all 13 offshore stations (6 ambient and 7 outfall) met the annual geometric mean standard, the monthly running geometric mean standard for all 12 months, and the peak fecal coliform standard for the surface samples (Figure C-2). The three standards were met at all additional sampling depths at each outfall station.

Results for the four nearshore stations were mixed (Figure C-2). The two nearshore stations in Quartermaster Harbor met all three standards. The nearshore station located at the mouth of the Lake Washington Ship Canal at Shilshole Bay met the annual geometric mean standard and the running monthly geometric mean standard for all 12 months. This station did not meet the peak standard, with fecal coliform counts exceeding 43 CFU/100 mL in 2 out of 12 samples collected in 2008. The nearshore station in Elliott Bay along the Seattle waterfront met the annual geometric standard for 2008. The Elliott Bay station did not meet the running geometric mean standard for the first nine months of 2008 but exhibited steady improvement until it met the standard for the last three months of the year. The station did not meet the annual peak standard; the standard was exceeded in 2 out of 12 samples collected. Both the Shilshole Bay and Elliott Bay stations, however, showed marked improvement in fecal coliform bacteria counts over the 2007 counts.

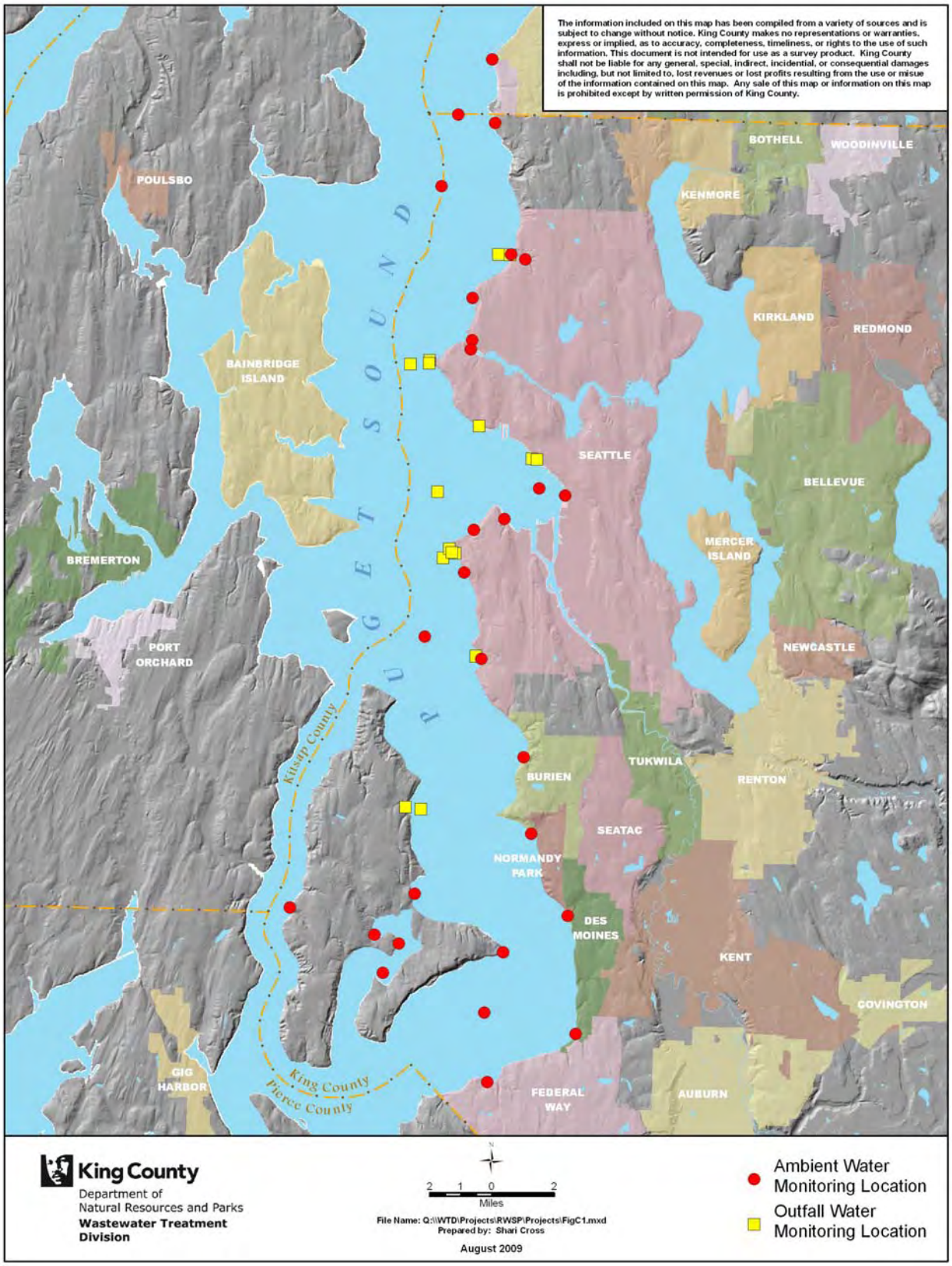

Figure C-1. 2008 Marine Ambient and Outfall Water Monitoring Locations

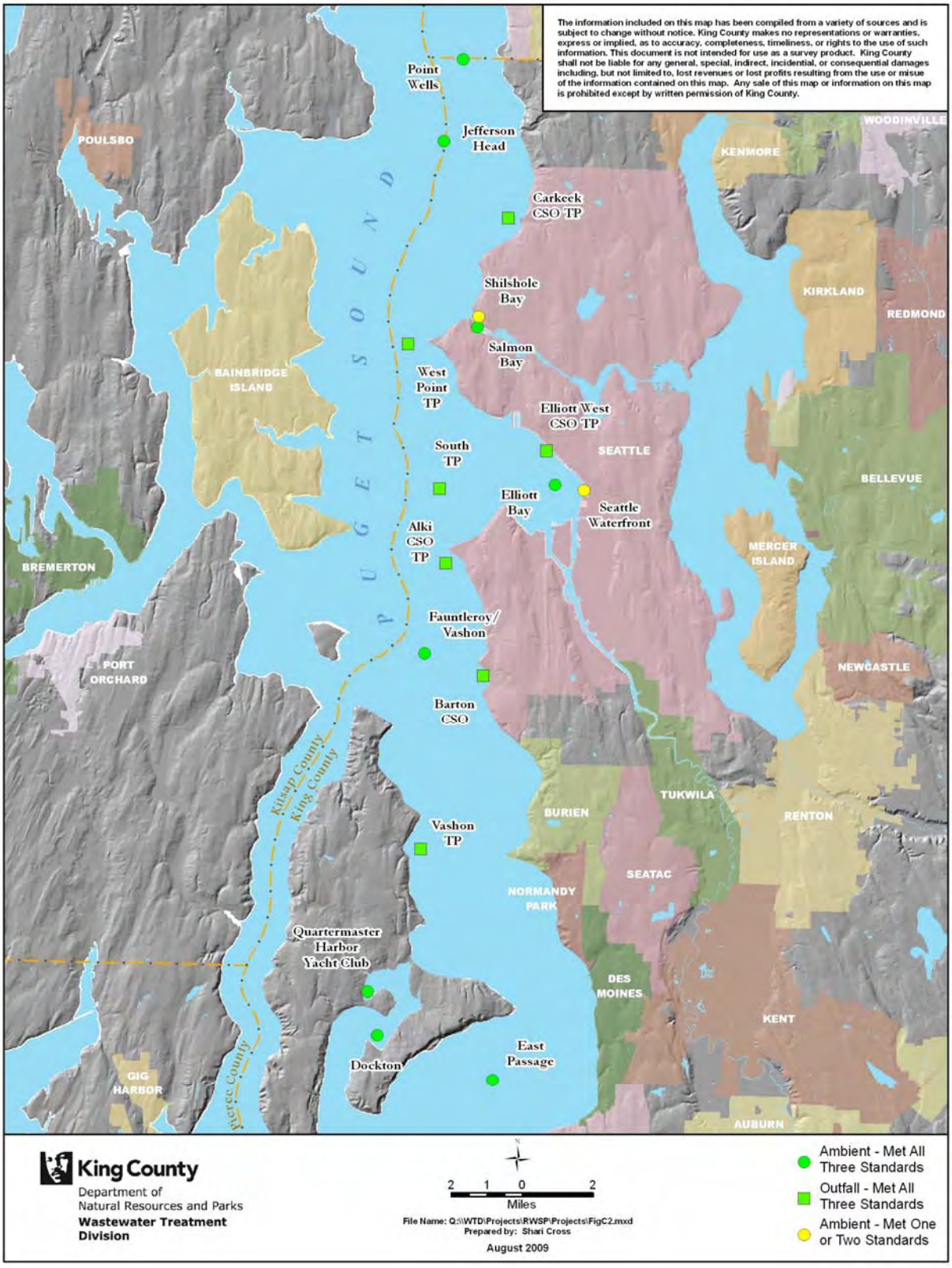

Figure C-2. Fecal Coliform Bacteria 2008 Results for Puget Sound Offshore and Nearshore Monitoring Stations

Water Quality Index

In 2008, King County monitored 14 sites, including 7 outfall sites, each month to assess overall quality of offshore marine water. To determine overall water quality, the county uses a modified version of the WQI developed by the Washington State Department of Ecology (Ecology). The determination is based on four indicators: DO, dissolved inorganic nitrate and nitrite (nitrate+nitrite), ammonia, and density stratification strength and persistence. Each monitoring site is categorized as low, moderate, or high concern based on the index.

Figure C-3 shows a conceptual diagram of the relationship between nutrients and oxygen in marine waters. Excess nutrients, nitrogen compounds in particular, can lead to excessive phytoplankton and algae growth that can then deplete oxygen concentrations when the algae die. Nitrogen and phosphorus are essential nutrients for marine plants and phytoplankton, particularly nitrate because phytoplankton preferentially take up nitrate and other nitrogen compounds. Low dissolved nitrate+nitrite concentrations for consecutive months indicate that the site may be at risk for eutrophication (the process by which excess nutrients lead to excessive phytoplankton and algal growth), while high ammonia concentrations indicate the presence of a nutrient source. Low DO serves as an indication of both stratification strength and high rate of plant growth driven by high nutrient concentrations.

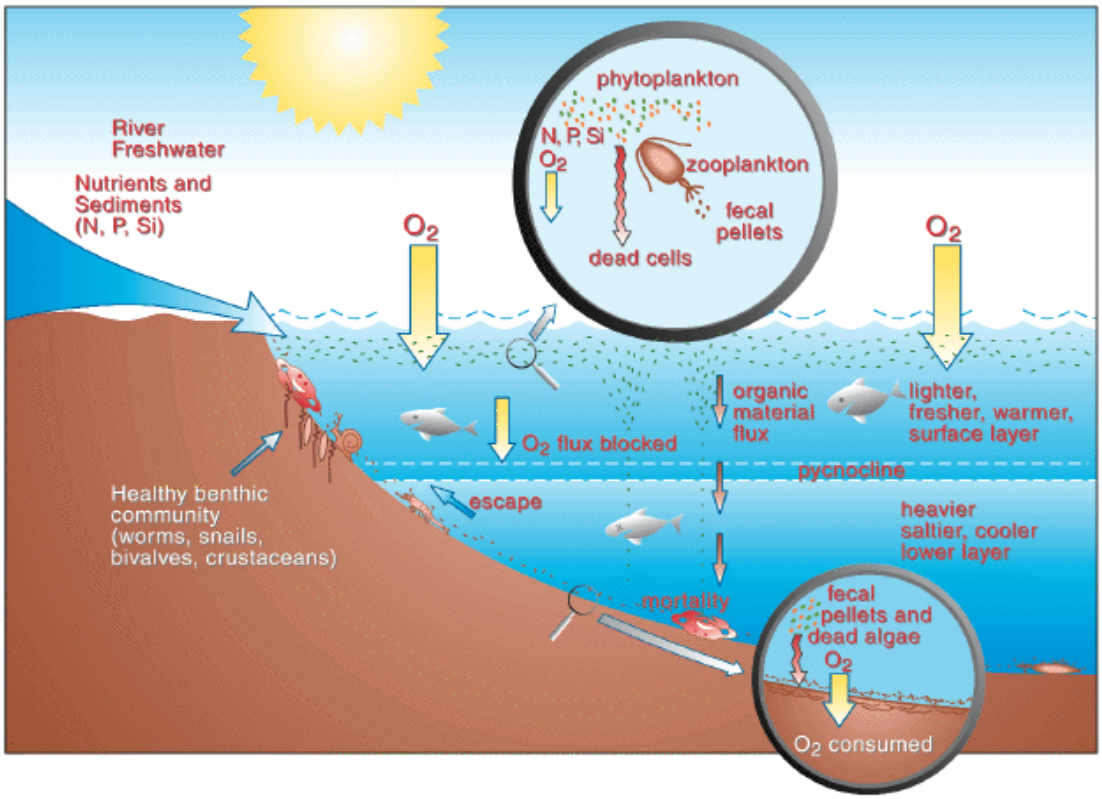

Figure C-3. Conceptual Diagram of Marine Nutrient-Oxygen Dynamics
(Source: Downing, J.A., et al. 1999.*Gulf of Mexico hypoxia: land and sea interactions.* Task force Report No. 134. Ames, IA: Council for Agricultural Science and Technology.)

Water density is a function of both salinity and temperature. Density increases with higher salinity and/or lower temperatures. Density stratification is an important factor that may influence physical processes such as mixing and circulation that, in turn, affect biological and chemical processes such as oxygen gradients and phytoplankton blooms. Strong and persistent stratification indicates reduced mixing between surface and bottom waters, which can trap waters with low DO near the bottom where many invertebrates live.

Figure C-4 shows the number of sites with moderate or high concern rankings over the last several years. All 14 offshore sites were ranked as low concern based on their WQI determinations. Although some sites in the Central Basin of Puget Sound experienced moderate-infrequent stratification, low DO levels were not observed. The 2008 rankings are similar to the previous few years, with the exception of 2007.

The two sites located in Quartermaster Harbor were considered a high concern in 2007. This ranking was based on nitrate+nitrite concentrations that were below the detection limits for five consecutive months. This pattern was not seen in 2008. One of the two stations had low nitrate+nitrite values but only for three consecutive months. Also in 2007, water quality at one of the Elliott Bay sites was ranked as moderate concern. The ranking was based on strong-intermittent density stratification and DO values of less than 5.0 milligrams per liter (mg/L) for two consecutive months. Although the density stratification at both Elliott Bay sites was classified as strong-intermittent in 2008, low DO levels were not seen.

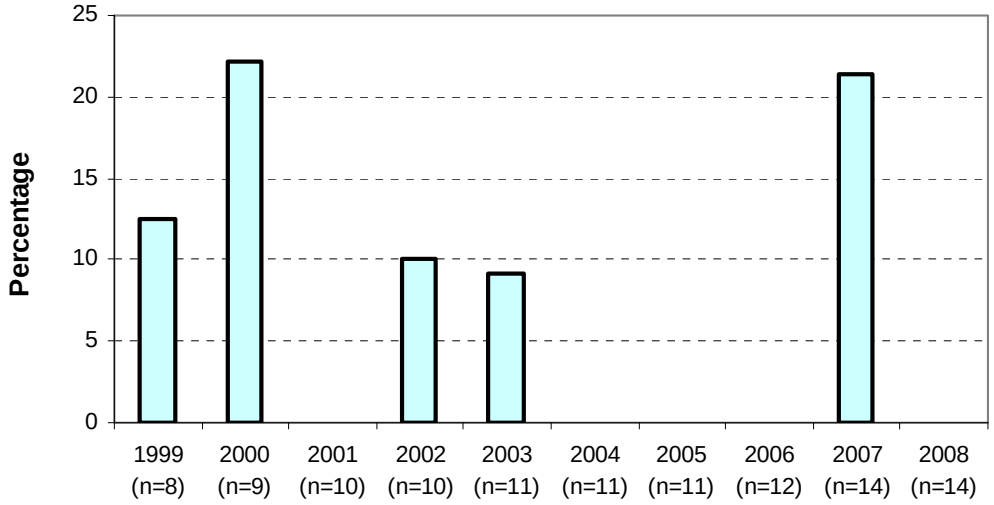

Figure C-4. Percentage of King County Offshore Stations with Moderate or High Concern Rankings Based on the Water Quality Index, 1999–2008

Dissolved Oxygen

Most marine organisms need sufficient oxygen levels for respiration and metabolic processes. The Washington State Surface Water Quality Standards for DO are 7.0 mg/L for a water body classified as "extraordinary" and 5.0 mg/L for a water body classified as "good." Adverse effects

can occur when levels drop to 3.0 mg/L and below. Not only can low DO levels cause death to nonmotile organisms (organisms incapable of movement), the toxicity of various pollutants can be increased and immune suppression effects on fish can make them more susceptible to disease. Physical processes affecting DO distributions in Puget Sound include the input of fresh and ocean water, stratification intensity within the water column, circulation patterns and mixing regimes, and the exchange of oxygen across the air-sea interface. Biological activity, such as photosynthesis and respiration, also affect DO levels and its distribution within the water column.

Surface marine waters remain well oxygenated throughout the year. However, the water below the photic zone (the region through which light penetrates) is less oxygenated because of the consumption of oxygen by the remineralization of organic material descending through the water column from the photic layer. Low DO concentrations can occur when organic matter is decomposed in waters that do not mix to the surface where aeration with atmospheric oxygen can occur. Upwelled deep waters and deep waters with overlying high organic production can have naturally occurring low DO concentrations.

DO measurements taken throughout the water column from 2005 through 2008 at all ambient and outfall offshore sites ranged from 3.6 mg/L to 15.4 mg/L. The lowest values were found in 2007 at the two Quartermaster Harbor (ambient) locations. These low levels have prompted more intense study of Quartermaster Harbor (see description below). Low levels of DO in the harbor may be due in part to shallow depths and limited flushing and input of oxygenated water. Excluding Quartermaster Harbor, low DO levels were observed in the same four-year period at the other stations at depths below approximately 50 meters in late summer and fall. These low levels are a result of the seasonal influx of Pacific Ocean water, which has low ambient concentrations of DO. Increased water column density stratification in the spring and summer also contributes to low DO levels in the deeper layers because it impedes vertical mixing. Surface/subsurface DO maximums were seen in spring and summer in the upper 35 meters approximately. The maximums correspond temporally and spatially with maximums in chlorophyll-*a* concentration and may therefore be attributed to plant growth.

Figure C-5 shows 2005–2007 seasonal DO variations at a representative station located in Puget Sound near Point Jefferson on the Kitsap Peninsula. Patterns resulting from the input of low-oxygenated Pacific water and consumption of oxygen by bacterial respiration over the late summer-fall months are evident in the deep layers of the water column and are typical of the pattern seen at other locations. The production of oxygen by plants in the upper layers during late spring and summer is also discernable. As the density gradient breaks down in the fall and winter, the water column becomes well mixed with little variability in DO levels from surface to depth.

Figure C-6 shows the seasonal variation in DO concentrations from 2005–2008 at both ambient and outfall offshore stations at discrete depths. Little difference was observed between ambient and outfall stations, indicating that effluent from the outfalls is not affecting DO concentrations.

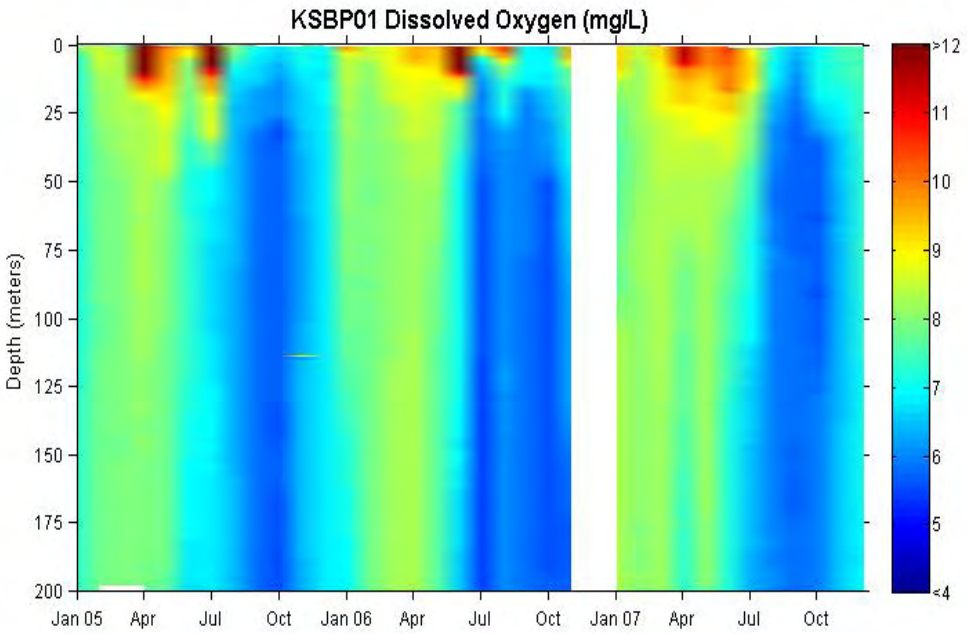

Figure C-5. Example of Seasonal Dissolved Oxygen Variation in Puget Sound, 2005–2007 (Source: *Water Quality Status Report for Marine Waters, 2005–2007*)

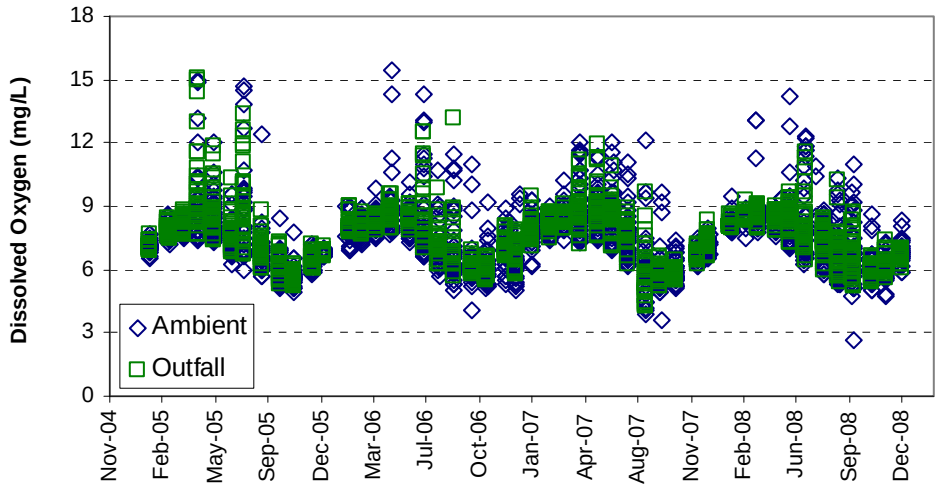

Figure C-6. Dissolved Oxygen at Puget Sound Ambient and Outfall Offshore Stations, 2005–2008

Chlorophyll-*a*

Phytoplankton are microscopic photosynthetic plants made up of two major groups: diatoms and dinoflagellates. Because chlorophyll-*a*, the main pigment controlling photosynthesis, is the only pigment usually found in all phytoplankton species, the amount of chlorophyll-*a* present can be used as an indicator of phytoplankton abundance and biomass. Chlorophyll-*a* concentrations are also used as an indicator of water quality because consistently high levels often indicate poor

water quality. Elevated chlorophyll-*a* levels routinely occur at various times of the year; however, it is the long-term persistence of these high levels that can lead to water quality problems.

Discrete samples for chlorophyll-*a* analysis are collected at depths between 1 and 35 meters. Not enough light penetrates below 35 meters to allow phytoplankton growth. In 2005–2008, chlorophyll-*a* values ranged from less than the detection limit to a high of 94.4 micrograms per liter (µg/L) in 2008. The highest value, and high values in general, were found at the two Quartermaster Harbor stations. The highest values are most frequently seen in April when large blooms (an accumulation of phytoplankton) are noted at most stations. These high chlorophyll levels coincide with high oxygen levels in the surface layer produced through photosynthetic activity.

The length of phytoplankton blooms can vary from a day to a month, depending on a variety of factors such as nutrient availability, amount of tidal exchange, and weather conditions. Strong winds and a large difference between the high and low tides tend to make blooms dissipate rapidly. Although chlorophyll-*a* samples are collected only monthly, 2005–2008 data indicate several spatial and temporal patterns. Phytoplankton blooms in the southern portion of the Central Basin occurred both earlier and later in the year than at other stations. Blooms in East Passage and Quartermaster Harbor occurred as early as March and as late as October. These blooms were not seen in other areas of the Sound during these times. The October 2006 and May 2008 blooms in Quartermaster Harbor were large, with a chlorophyll-*a* concentration of 43.5 µg/L at the inner harbor station and 94.4 µg/L at the outer harbor site. The May 2008 bloom was seen only in Quartermaster Harbor and was not observed at other sites in the Central Basin. There was no difference in the frequency of blooms between outfall and ambient stations.

Nitrogen, in the form of ammonia and nitrate+nitrite, was depleted in surface waters to levels below the detection limit because of phytoplankton uptake during the large blooms. For all stations, the maximum chlorophyll-*a* concentration was a few meters below the surface, generally between 4–6 meters depending on the station and weather conditions. Several factors can influence the depth where maximum chlorophyll-*a* concentrations are detected, including water column stratification and photoinhibition (reduction in a plant's ability to photosynthesize from exposure to strong light).

Ammonia

In marine waters, ammonia can be found at elevated concentrations as a byproduct of wastewater (discharged from municipal treatment plants and onsite septic treatment systems) and of agricultural and fertilization practices in urban areas. Elevated ammonia levels may also be seen following large phytoplankton blooms because ammonia is produced during the decay process.

In 2005–2008, the highest measured concentration in offshore waters was more than six times lower than the Washington State water quality ammonia standard. Most ammonia concentrations ranged from less than the detection limit of 0.010 mg/L to a maximum of 0.25 mg/L in 2005. The highest concentrations of ammonia generally occur in summer and autumn, and the lowest concentrations occur in winter. Ammonia concentrations in samples from both outfall and ambient offshore stations generally increased with depth, illustrating that uptake is primarily

from phytoplankton in the photic zone and that lowered uptake and increased excretion by zooplankton are occurring below the photic zone.

Figure C-7shows 2005–2008 ammonia concentrations at all ambient and outfall offshore stations. Overall, there was little difference in average ammonia concentrations between ambient and outfall sites. The two Quartermaster Harbor stations had the highest average concentrations (0.042 and 0.033 mg/L) when compared to all other stations. The West Point Treatment Plant outfall had the third highest average value of 0.022 mg/L. If the Quartermaster Harbor stations are excluded from the overall average value of ambient stations, a slight difference is evident in average concentrations between ambient and outfall stations, with the outfall sites having a higher average.

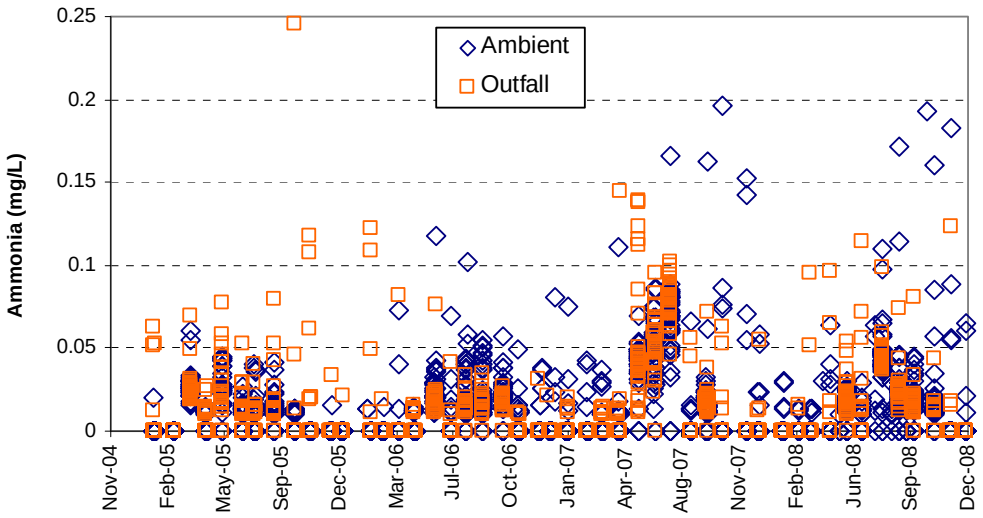

Figure C-7. Ammonia Values at Puget Sound Ambient and Outfall Offshore Stations, 2005–2008

Ambient and Outfall Locations at Puget Sound Beaches

Fecal coliform bacteria levels at 25 Puget Sound beach stations were measured monthly in 2008 to assess the risks to human health from direct contact with marine waters during activities such as swimming, wading, scuba diving, and windsurfing. Sixteen stations are located in ambient areas, and nine stations are in the vicinity of King County treatment plant and CSO outfalls. Although all of the county's treatment plant and CSO outfalls are located in offshore waters, beach areas that are inshore of the outfalls are considered outfall beach stations.

The same fecal coliform standards used to assess offshore and nearshore samples were applied to the samples collected at Puget Sound beach stations. The 2008 fecal coliform monitoring results for beach stations are shown in Figure C-8 and described below:

- Fourteen stations (3 outfall and 11 ambient) met the annual geometric mean standard, the running geometric mean standard for all 12 months, and the peak standard.

- Three stations—Golden Gardens (ambient), Alki Beach south of the lighthouse (outfall), and at Seahurst Park (ambient)—met both the annual geometric mean and peak standards but did not meet the running geometric standard for one or more months in 2008. In all three cases, the geometric mean value showed improvement over the course of the year.
- The station located on the south side of West Point (outfall) met both the annual geometric mean standard and the running geometric mean standard for all 12 months but did not meet the annual peak standard, with bacterial counts that exceeded 43 CFU/100 mL in 2 out of 12 samples.
- The station located inshore of the Magnolia CSO exceeded the peak standard in 3 out of 12 samples and exceeded the running geometric mean standard for several months but met the annual geometric mean standard by year end.
- The following six stations did not meet the annual geometric mean and peak standards, nor did they meet the monthly running geometric mean for several months in 2008:
    - Edwards Point in Snohomish County (ambient). An off-leash dog park is located near this station, which may contribute to elevated fecal coliform counts.
    - Carkeek Park at the mouth of Piper's Creek (outfall). This station is located in the freshwater plume of Piper's Creek as it enters Puget Sound downstream of the Carkeek CSO Treatment Plant. Another Piper's Creek monitoring station, located upstream of the treatment plant, also exhibits constantly elevated fecal coliform bacteria counts. Past source tracing activities in this area indicate that the elevated fecal coliform counts in Piper's Creek may be caused by raccoons and feral cats.
    - Richey Viewpoint near Alki (outfall). This station is located close to both the 63rd Street SW CSO outfall and a City of Seattle storm drain and may receive inputs of fecal coliform bacteria during rain events.
    - Fauntleroy Cove (outfall). This station is located near the Barton Street CSO and other inputs into Fauntleroy Cove, including Fauntleroy Creek and several City of Seattle storm drains, and may receive inputs of fecal coliform bacteria during rain events.
    - Normandy Park (ambient). Although this station is considered an ambient station, it is located near the outfall for the Miller Creek Treatment Plant, operated by the Southwest Suburban Sewer District. The station is also located near a natural creek that discharges across the beach.
    - Redondo Beach (ambient). This station has had ongoing elevated fecal coliform bacteria counts and has been monitored both by King County and the Washington State Department of Ecology BEACH program.[6] Although this station is considered ambient, the outfall for the Lakehaven Utility District's Redondo Treatment Plant is near this station and may contribute to the elevated bacterial counts. The outfall has recently been upgraded to discharge further offshore at a deeper depth.

[6] BEACH = Beach Environmental Assessment, Communication and Health.

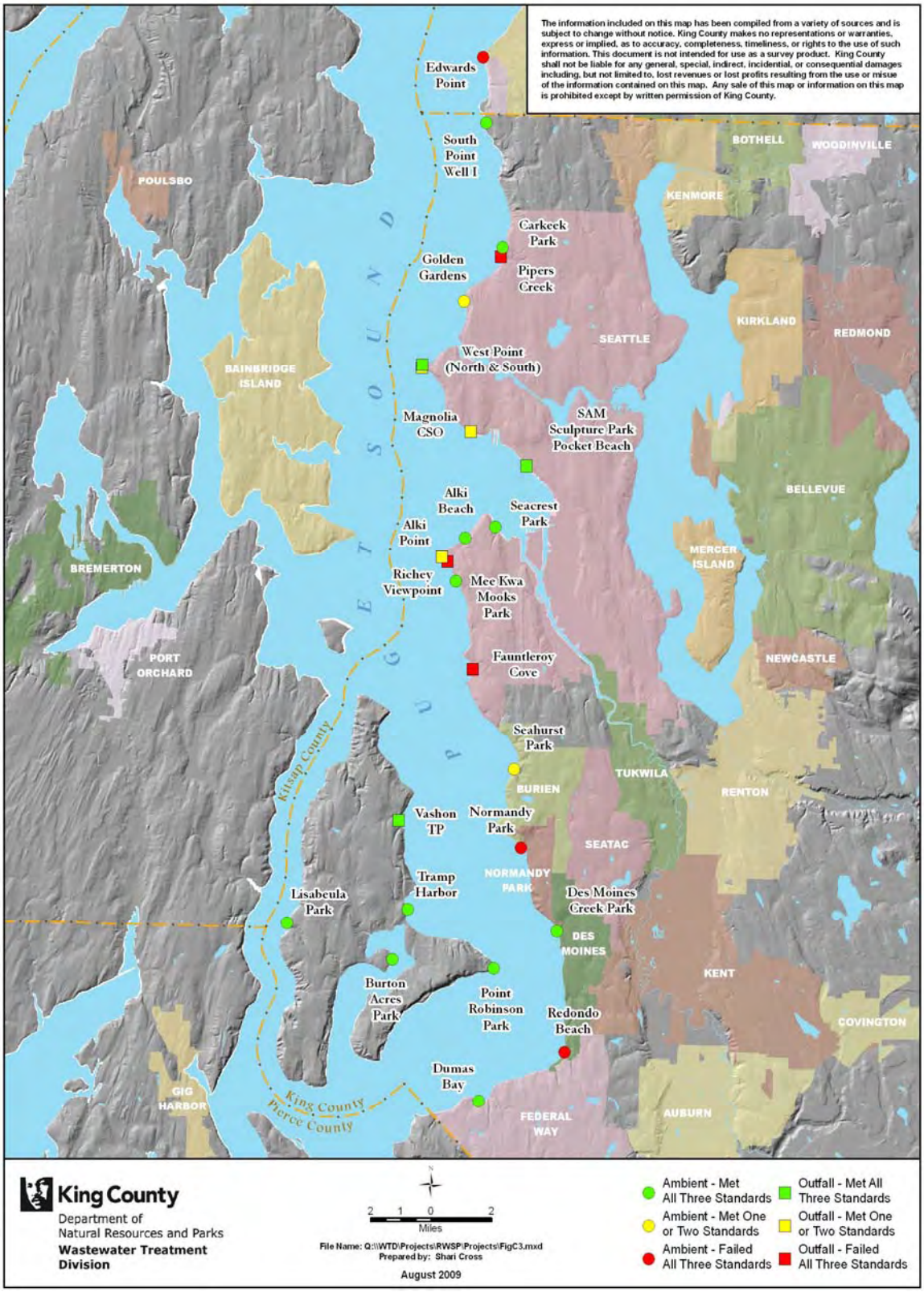

Figure C-8. Fecal Coliform Bacteria 2008 Results for Puget Sound Beach Monitoring Stations

Quartermaster Harbor Study

In 2008, King County was awarded a West Coast Estuaries Initiative grant by Region 10 of the EPA to conduct the Quartermaster Harbor Nitrogen Management Study. The study is funded through 2012. Partners working with King County on the study include Ecology and the University of Washington-Tacoma.

Quartermaster Harbor, located between Vashon and Maury Islands, is sheltered from wind and waves and receives runoff from about 40 percent of Vashon-Maury Island. Inner Quartermaster Harbor is especially sheltered. Judd Creek, located in the northwestern portion of the inner harbor, is the largest freshwater input. The harbor is a regionally significant natural resource area. Approximately 60 species of fish, 78 species of birds, several species of marine mammals, and a variety of marine invertebrates inhabit or use Quartermaster Harbor.

Near lethal DO levels have been observed in Quartermaster Harbor over the last three years of monthly monitoring. These low levels, combined with the high habitat value of Quartermaster Harbor, increased frequency of detections of nitrates in Vashon–Maury Island groundwater, and ongoing population growth, make this project a high priority for King County. The harbor is one of 19 areas of Puget Sound judged to be relatively sensitive to anthropogenic nutrient inputs.[7]

Quartermaster Harbor has many characteristics similar to Hood Canal, and is believed to be at risk of lethal low oxygen events such as those that have occurred in Hood Canal on multiple occasions this past decade. Eelgrass losses, fish kills, and harmful algal blooms have been attributed to eutrophication and lethal low oxygen events in Hood Canal. Evidence suggests that Quartermaster Harbor is a source of *Alexandrium*, a single-celled organism responsible for toxic algal blooms.[8]

Study objectives are as follows:

- To determine the relative nitrogen loadings by source type, including onsite septic systems, livestock (manure), fertilizer, alder forests, and other, and collect high frequency marine data using buoys.
- To identify Best Management Practices with assistance from regulatory and policy partners that address the land uses with the largest loadings as determined in this proposal.
- To model the effectiveness of nitrogen management on DO levels and to compare the level of effectiveness of different management options with conceptual cost estimates.
- To develop, in collaboration with residents and other agencies and departments, new policies for the 2012 King County Comprehensive Plan update related to nitrogen

[7] Rensel Associates and PTI. 1991. Nutrients and phytoplankton in Puget Sound. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. PTI Environmental Services, Bellevue, WA.

[8] Greengrove, C.L., B. W. Frost, R.A. Horner, J.R. Postel, J.E. Gawel, K.S. Davies-Vollum, A. Cox, S. Hoffer, K. Sorensen, and J. Hubert. 2006. *Survey of Alexandrium cysts in the surface sediments of Puget Sound, Washington.* ASLO Summer Meeting in Victoria B.C.

management on Vashon–Maury Island and to recommend management actions for implementing the new policies.

Funding for this study will support the continuation of the Vashon–Maury Island Water Resources Evaluation of surface stream and groundwater quantity and quality (http://www.kingcounty.gov/environment/waterandland/groundwater/management-areas/vashon-maury-island-gwma/vashon-island.aspx). In addition, the grant funding will support special studies of nitrogen sources to the harbor (including onsite septic systems), the development and application of watershed and marine receiving water models, and the continuation of ongoing monitoring activities conducted by the University of Washington-Tacoma (http://courses.washington.edu/uwtoce06/webg2/index2.html).

The study will depend in part on King County marine ambient monitoring work in Quartermaster Harbor. Three stations are visited monthly and two moorings record data every 15 minutes. One mooring is at Dockton and the other is at the harbor entrance. Mooring data are currently transmitted to an external Web site: http://www.ysieconet.com/public/WebUI/Default.aspx?hidCustomerID=165.

The study area is shown in Figure C-9. Because of the similarity of this study area to rural lands draining to Puget Sound, results and knowledge gained from the study may be transferable to a large part of Puget Sound.

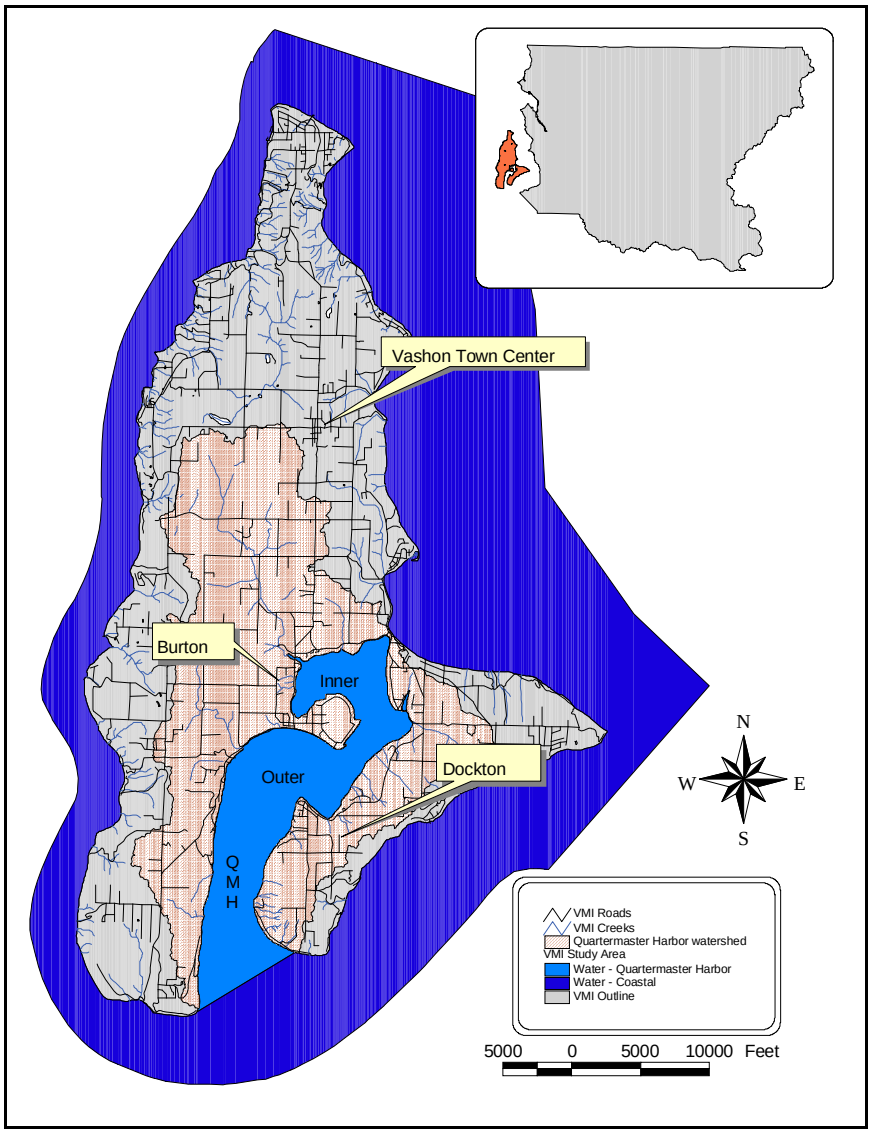

Figure C-9. Study Area for the Quartermaster Harbor Nitrogen Management (cross-hatched area)

Marine Sediment Monitoring Results

Not only can sediments be impacted by pollutant discharges, they also can be a source of pollution through resuspension to the water column and through the food chain as benthic organisms and shellfish are consumed. Marine sediment monitoring occurred at two sites in 2008: the Denny Way/Elliott West CSO outfalls and the Duwamish/Diagonal Sediment Remediation Project. In addition to describing this monitoring, the following subsections describe ongoing sediment monitoring programs whose results give an indication of the condition of sediments in Puget Sound and Elliott Bay, near WTD marine outfalls, and in areas near CSO outfalls undergoing sediment remediation. These areas will receive additional monitoring in the future.

Ambient Locations in Puget Sound and Elliott Bay

For many years, King County collected sediment quality data from subtidal ambient monitoring stations in Elliott Bay and in the Central Basin of Puget Sound near Seattle. The program was temporarily discontinued after 2004 to enable staff scientists time to evaluate data generated from the program and from other data collection efforts in the region. Following the review, the county began an expanded subtidal sediment monitoring program in 2007 that focuses on sediment quality in Elliott Bay while also monitoring ambient sediment quality in the Central Basin of Puget Sound and in three embayments of interest—Quartermaster Harbor, Fauntleroy Cove, and outer Salmon Bay. Locations of sampling stations are shown in Figure C-10 (stations that are not in insets on the figure). The eight stations in Elliott Bay are sampled every two years; the six ambient stations are sampled every five years.

In 2007, King County collected subtidal sediment samples from all 14 locations, analyzed them for metals and organic chemicals, and compared concentrations to the published sediment quality chemical criteria of the Washington State Sediment Management Standards (SMS) and to region-wide Puget Sound sediment data. In general, the analysis found the sediment quality at areas sampled in Elliott Bay, Puget Sound, and three associated embayments to be of good quality with some evidence of minor impacts from human activities at three locations. Sediment samples will be collected from the eight Elliott Bay stations in June 2009 as part of the routine biennial sampling cycle. Sediment samples at the other six ambient monitoring locations in the Puget Sound Central Basin and three associated embayments will next be collected in June 2012.

Treatment Plant Outfalls

Sediment samples are usually collected in the vicinity of existing treatment plant marine outfalls once during each NPDES permit cycle (usually five years).

Near South Treatment Plant Outfall

Sediment sampling was not required during the last NPDES permit cycle for the South Treatment Plant because samples from previous monitoring did not show evidence of contamination. A permit renewal application will be submitted and permit requirements will be negotiated in 2009.

Near the West Point Treatment Plant Outfall

Surface sediment samples were collected in September 2006 for the West Point Treatment Plant. A final report was issued to Ecology in 2007. The next NPDES cycle will begin sometime in 2009.

Results of the 2006 sampling showed that all 19 stations passed Washington State SMS chemical criteria. Samples from three stations near the end of the diffuser failed one or more sediment bioassays, exceeding SMS biological criteria (West Point inset, Figure C-10). However, chemical concentrations at the three stations were well below SMS chemical criteria. The stations also support a robust, diverse benthic community that has been stable over the last three

monitoring events completed between 1998 and 2006.[9] (One of the stations was resampled for benthic community analysis in 2007, and analysis was completed in 2008.) Benthic infaunal organisms are excellent biological integrators of chemical and physical sediment conditions and, as such, are considered a sensitive indicator of a healthy marine environment.[10]

Six stations were sampled and analyzed to classify sediment quality using the Puget Sound Sediment Quality Triad. To do this, samples for analysis of sediment chemistry, toxicity, and benthic community assemblages were collected at the same time. Sediments at four of the six stations were classified high quality. Two stations were classified as intermediate/high quality; these were two of the three stations whose bioassay results did not correlate with chemistry and benthic results.

Near the Future Brightwater Outfall

In 2001, 2006, and 2007, King County collected preconstruction baseline sediment quality data at 10 stations in the vicinity of the planned diffuser for the Brightwater Treatment Plant marine outfall and at one nearby reference station (Brightwater inset, Figure C-10). In general, sediment quality was found to be good, with a stable benthic community typical of the type of sediment found at the site and little evidence of impacts from chemical compounds.

This three-year effort was determined sufficient to fully characterize baseline sediment quality prior to construction and operation of the Brightwater marine outfall. Sediment sampling will occur again in either October 2010 or October 2011, depending on the construction and testing schedule for the Brightwater System, to update the baseline just prior to outfall operation.

[9] "Robust" means that it is a healthy and thriving benthic community that is able to stand up to the rigors of statistical analysis.

[10] Benthic infauna live in soft substrate areas such as shallow mud flats and sand flats. They include worms, bivalves and crustaceans. All these species have burrowing mechanisms. Benthic communities provide a significant food source for many species of fish, other aquatic organisms, and wading birds.

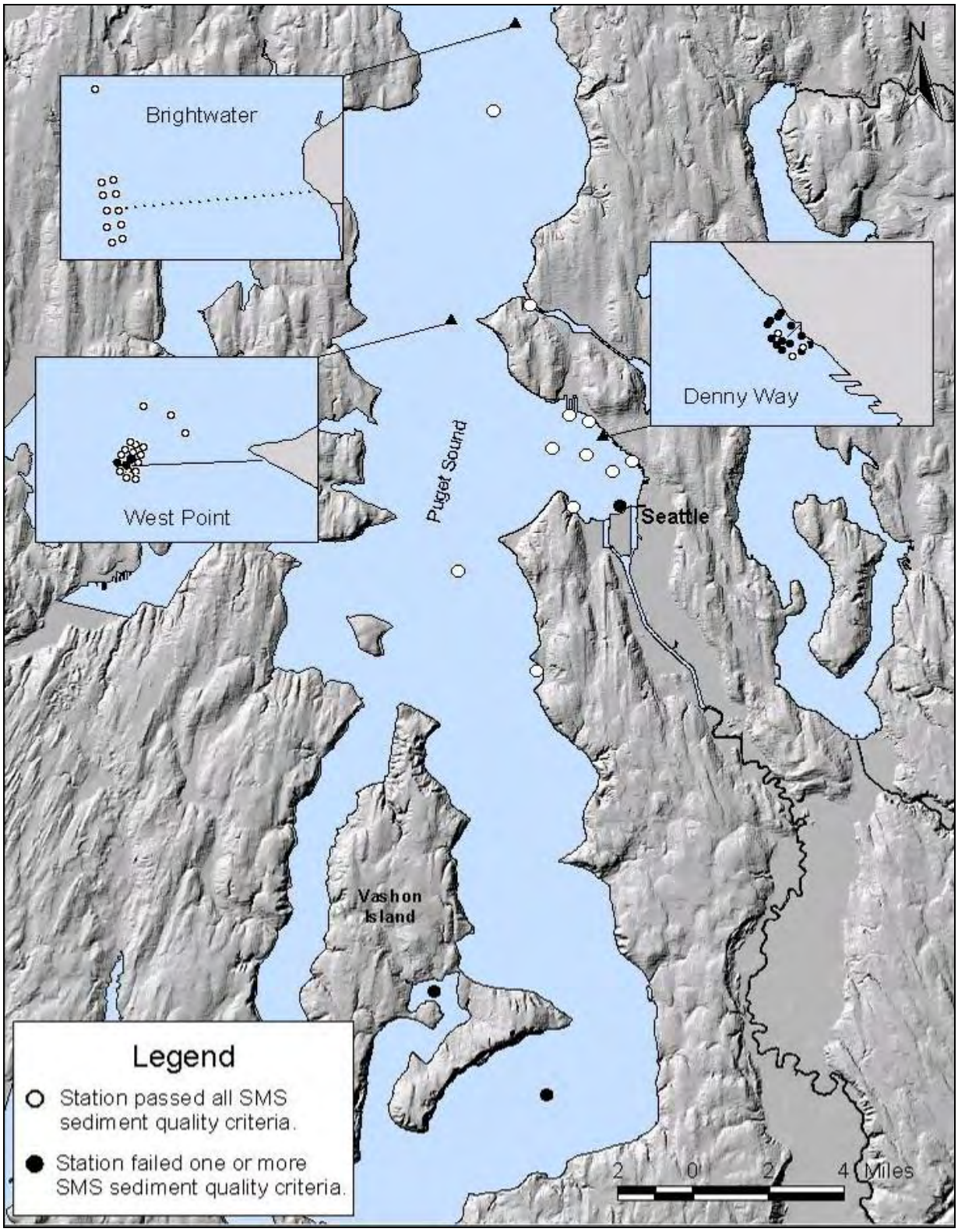

Figure C-10. Sediment Monitoring Stations in Elliott Bay and Central Basin of Puget Sound

Sediment Remediation Projects

Near the Denny Way/Elliott West CSO Outfalls

Two new outfalls went online in 2005 as a part of the Mercer/Elliott West CSO control system. One outfall discharges primary-treated effluent from the new Elliott West CSO Treatment Facility; the other outfall discharges untreated CSO from the Denny Way Regulator Station and replaces the previous outfall that was closer to shore. The area inshore of the outfalls underwent remediation of historical sediment contamination from the former outfall before the site was controlled and from other unrelated inputs. Remediation was completed in early 2008. A 10-year monitoring program will track results of the remediation. King County and Ecology are monitoring three other subareas to see whether they will recover naturally or will require further remediation.

In April 2008, sediment samples were collected from 19 stations for chemical analysis. Thirteen stations are part of a long-term monitoring program. The other six stations were sampled to assess whether contaminated sediment had spread during remediation (Denny Way inset, Figure C-10). Eight of the long-term stations were also sampled for analysis of the benthic invertebrate community. Data are still undergoing analysis; early results indicate that the remedial activities did not appear to significantly impact sediment quality near the remediation area. Analysis of the long-term monitoring stations indicates that concentrations of one or more chemicals at 8 of the 13 stations sampled exceeded Washington SMS chemical criteria and that benthic assemblages in both the new and former CSO outfall locations show minor impacts from the new outfall operation.

Duwamish/Diagonal Sediment Remediation Project in the Duwamish Waterway

King County conducted a sediment remediation project at the Duwamish/Diagonal CSO/Storm Drain (SD) between November 2003 and March 2004, as part of the Elliott Bay/Duwamish Restoration Program (EBDRP). The objective of the project was to remediate contaminated sediment within a 7-acre area immediately adjacent to the Duwamish/Diagonal CSO/SD and the old Diagonal Treatment Plant outfall. The project included removal of 3 to 5 feet of contaminated sediments from two areas (A and B) and placement of a capping layer. In 2005, King County placed a 4-acre thin-layer cap around one of the capped areas because of elevated concentrations of polychlorinated biphenyls (PCBs) measured in perimeter sediment samples.

The monitoring plan stipulates monitoring for a minimum of five years. In 2008, sediment samples were collected on March 24 and 25 from a total of 23 stations in four monitoring areas: the two initial capped areas (A and B), the thin-layer capped area, and perimeter stations. Preliminary analysis of the 2008 data indicates that there are no chemical exceedances of SMS in Area B. Butylbenzylphthalate, bis-2-ethylhexyl phthalate, dimethylphthalate, and phenol concentrations exceeded SMS in some samples in Area A, the thin-layer cap, and the perimeter. As in previous years, PCB concentrations exceeded SMS at some stations in the perimeter area but concentrations have been decreasing over time. Overall, contaminant concentrations in Areas A and B are below those measured before remediation and continue to decrease each year.

Harbor Island Superfund Project[11]

King County is working in partnership with the Port of Seattle and the City of Seattle on the Harbor Island Superfund project. The project area includes two county CSOs, one city CSO, and multiple storm drains that discharge to the East Waterway. A supplemental remedial investigation (SRI) is being conducted to evaluate the nature and extent of chemical contamination and risk to human health and the environment from contaminated sediments. A feasibility study (FS) is also being conducted that will present remedial alternatives to address risks found at the site. The draft SRI is expected to be completed in February 2011 and the draft FS in December 2011.

Some Chemicals Defined…

PCBs (polychlorinated biphenyls). Used in electrical equipment, paints, hydraulic fluids, plastics, dyes, and other products, before being banned in the U.S in 1977. Known to cause cancer in animals and produce health effects in humans.

PAHs (polycyclic aromatic hydrocarbons). Byproducts of combustion of coal, oil, gas, wood, garbage, and tobacco, and in charbroiled meat. May cause cancer, reproductive problems, birth defects, impaired immune function, and other health effects. (cPAHs are carcinogenic PAHs.)

Phthalates. Used in a variety of consumer products such as plastics, deodorant, nail polish, and perfume. Found to cause adverse health effects, including cancer, in laboratory animals.

Furans (and related dioxins). Byproducts of combustion, manufacture of herbicides, and bleaching of paper pulp. Found to cause adverse effects, including endocrine disruption, in laboratory animals. May cause cancer in humans.

In 2008, the county partnered with the Port of Seattle on a sediment removal project off the Lander CSO/storm drain outfall and the port's Terminal 30. This project is expected to be completed in 2009.

Other work in 2008 included planning and implementing source control activities, including business inspections and sampling, in order to supplement available chemistry data on CSOs. King County installed sediment traps and collected wet-weather wastewater samples from the Hanford No. 2 Regulator Station, collected solids samples during low flow from the Hanford No. 2 and Lander Street combined sewers, and collected wastewater samples for volatile organic compound analysis from the same sewers. In 2009, the effluent samples will be analyzed for PCBs, total organic carbon (TOC), semivolatile organic compounds (SVOCs), and metals. The solids samples are being analyzed for PCBs, total solids, TOC, SVOCs, and selected heavy metals. Results will indicate if additional source tracing is needed.

Also in 2008, the county collected samples of stormwater runoff to assess potential PCB concentrations in stormwater that enters the combined sewers from the south end of the old Rainier Brewery site that drains to the East Waterway.

Lower Duwamish Waterway Superfund Project

In 2001, the EPA added about five miles of the Lower Duwamish Waterway (LDW) to its list of Superfund cleanup sites. Nine county CSOs are located in this stretch of the waterway. King County, the Port of Seattle, the City of Seattle, and Boeing became involved early in the process before the site was listed under Superfund and are participating in the preparation of a remedial investigation and feasibility study (RI/FS).

[11] Superfund is the common name for the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Enacted by Congress in 1980 and amended in 1986, this law provides broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

The four partners are providing data previously collected or are collecting new data for the effort. King County work in 2008 included source control sampling and analyses. Sampling of industrial sewer dischargers for phthalates was done to determine if there are controllable industrial sources of these chemicals. Analysis indicated that the average industrial wastewater concentration of phthalates was at approximately the same concentration found in domestic/commercial areas of King County's wastewater system. In addition, sampling was conducted to evaluate the atmospheric deposition pathway to the LDW for phthalates, carcinogenic polycyclic aromatic hydrocarbons (PAHs), and PCBs. Analysis of the samples indicated that atmospheric deposition is a pathway that needs to be considered when evaluating sources of contamination to the LDW. The final reports for both sampling efforts were completed in 2008.

The following sections describe the progress made on the RI/FS.

Draft Remedial Investigation

Phase 1 of the RI examined existing data on the risks to human health and the environment from sediment-associated chemicals in the LDW. As a result of the Phase 1 study, EPA identified seven early action sites. Two of the seven early action sites were near the county's Norfolk and Duwamish/Diagonal CSOs. Sediment near the Norfolk site had already been remediated in 1999; remediation of the Duwamish/Diagonal sediment was completed in 2004 (see above). Phase 2 of the RI filled identified data gaps and included additional modeling to complete the RI and support the FS. The draft RI was circulated for public review in November 2007 and is expected to be finalized in late 2009. Some key findings of the RI are as follows:

- The waterway contains a diverse assemblage of aquatic and wildlife species and a robust food web that includes top predators.
- Much of the sediment contamination resulted from historical releases that are now generally buried under cleaner more recently deposited sediment. Almost all new sediment that enters the waterway comes from the Green River.
- In general, high concentrations of chemicals, including PCBs, were detected in surface sediment in localized areas—frequently called "hot spots"—separated by larger areas of the LDW with lower concentrations. Relatively high surface sediment contamination is present in some areas as a result of a number of processes, including low net sedimentation rates in a few areas with primarily historical contamination or because of the presence of ongoing localized sources.
- The highest risks to people are associated with consumption of fish, crabs, and clams, with lower risks associated with activities that involve direct contact with sediment, such as clamming, beach play, and netfishing.
- Most of the human health risk is from PCBs, arsenic, carcinogenic PAHs (cPAHs), and dioxins and furans.
- Ecological risks to fish and wildlife were relatively low, with the exception of risks to river otter from PCBs.
- Sediment contamination in approximately 75 percent of the LDW is estimated to have no effect on the benthic invertebrate community; approximately 7 percent of the surface

sediment has chemical concentrations exceeding the higher of the two state standards associated with potential adverse effects to the benthic invertebrate community. The potential for effects in the remaining 18 percent of the LDW is more uncertain. Most of the state sediment standard exceedances were for PCBs and phthalates, although 41 different chemicals had at least one exceedance.

The draft RI included two recommendations in its key findings:

- The control of local sources of toxics is critical to the long-term success of specific remedial actions in the LDW.
- Continued coordination of cleanup actions and source control will be necessary to ensure that any actions taken are not unduly impacted by local sources.

Draft Feasibility Study

The draft FS presents cleanup objectives and alternatives to address sediment contamination in the LDW. The cleanup objectives are as follows:

- Reduce human health risks associated with the consumption of resident LDW seafood by reducing surface sediment concentrations of chemicals of concern (COCs) to protective levels.[12]
- Reduce human health risks associated with exposure to COCs through direct contact with sediments and incidental sediment ingestion by reducing surface sediment concentrations of COCs to protective levels.
- Reduce risks to benthic invertebrates by reducing surface sediment concentrations of COCs to comply with the Washington State Sediment Management Standards.
- Reduce risks to crabs, fish, birds, and mammals from exposure to COCs in surface sediment by reducing surface sediment concentrations of COCs to protective levels.

Cleanup alternatives are shown in Figure C-11, which appears as Figure ES-4 in the executive summary of the draft FS. The alternatives move from the least-cost No Further Action Alternative through four other alternatives with increasing levels of action and costs.

The draft FS makes three recommendations:

- Identify an approach for cleanup of the most contaminated areas first (a “worst first” approach). Cleaning up the most contaminated areas achieves the greatest reduction in risk, while ongoing natural recovery processes are expected to concurrently reduce risk in less contaminated areas and LDW-wide.
- Collect monitoring information during and after cleanup to guide the reevaluation of the effectiveness of the selected remedial alternative.
- Continue active cleanup as needed to produce significant results within a reasonable timeframe.

[12] “Protective” means protective of human health and the environment.

The draft FS will be available for public comment in April 2009 (http://www.ldwg.org/index.htm). The agencies will issue a final FS in 2010 and a proposed cleanup plan in 2011.

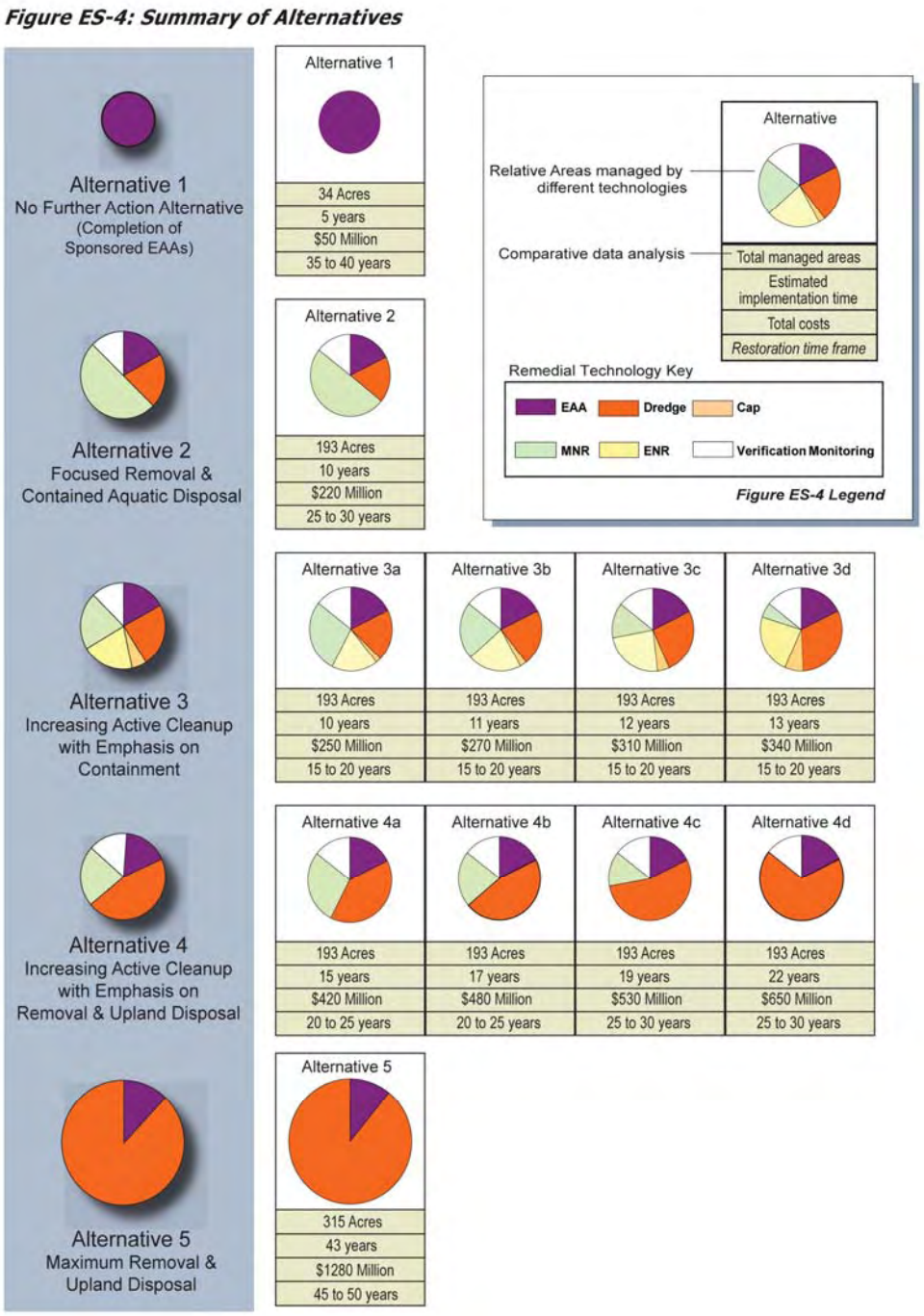

Figure C-11. Alternatives for Cleanup of Contaminated Sediments in the Lower Duwamish Waterway

(Source: *Draft Feasibility Study, Lower Duwamish Waterway,* Lower Duwamish Waterway Group, 2009)

Major Lakes Water Monitoring Results

This section describes the results of fecal coliform bacteria sampling at ambient and swimming beach locations in the major lakes of King County. It also describes overall water quality in these lakes based on calculation of their trophic state index.

Ambient Mid-Lake (Open Water) and Nearshore

Figure C-12 shows the location of the 25 ambient sampling locations in Lakes Washington, Sammamish, and Union and in the Lake Washington Ship Canal.

Figure C-12. Ambient Monitoring Locations in Lakes Washington, Sammamish, and Union (including the Lake Washington Ship Canal)

Fecal Coliform Bacteria

Samples are collected for fecal coliform bacteria from both mid-lake (open water) and nearshore locations in Lakes Washington, Sammamish, and Union biweekly during the growing season and monthly during the rest of the year.

The lake standard for fecal coliform bacteria addresses human health risk from direct contact with lake water during activities such as swimming and wading. The standard is a geometric mean value of less than 50 colonies per 100 mL with no more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 100 colonies per 100 mL (Chapter 173-201A WAC).

Even though the lake standard for fecal coliform bacteria is exceptionally difficult to attain, 100 percent of the stations in Lakes Union, Washington, and Sammamish achieved the standard in 2008 (Figure C-13). Historically, higher bacteria concentrations have been measured in Lake Washington and Lake Union when sampling occurred shortly after major storm events at stations that are influenced by CSO or stormwater outfalls.

Routine lake monitoring will be reduced in 2009 as the result of budget cuts. Fecal coliform monitoring will continue at only three stations in Lake Union (Stations A522, 0512, and 0540 on Figure C-12) to detect existing and potential problems with the county conveyance system. A focused assessment of stormwater loading at designated stations in Lake Union and south Lake Washington are planned for the future if funds are available.

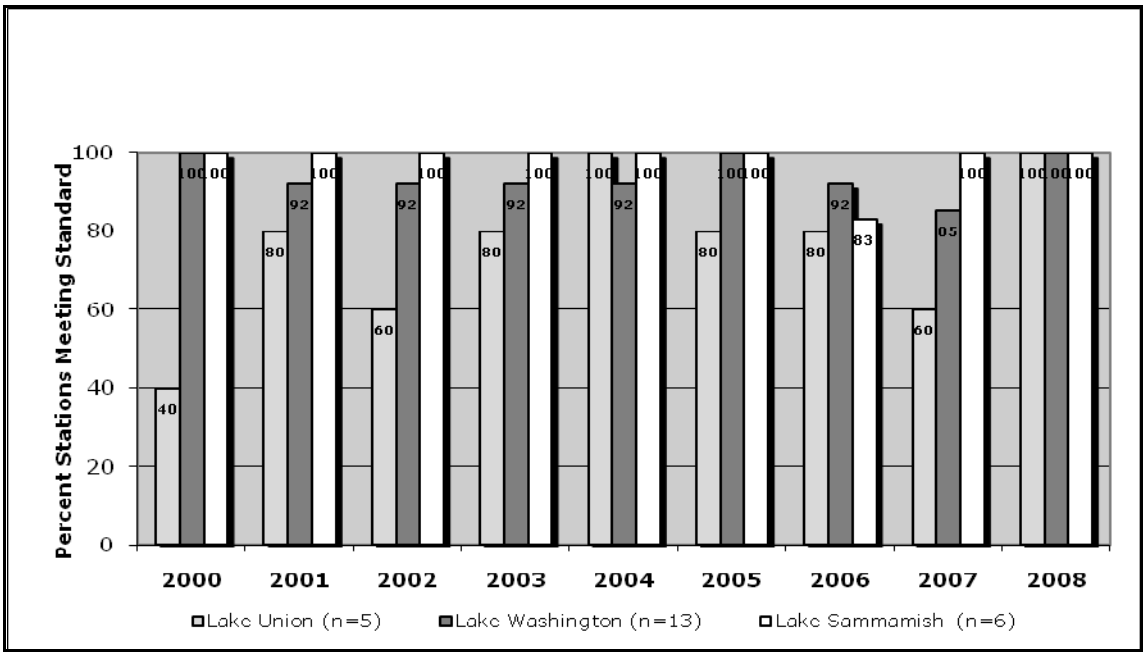

Figure C-13. Percentage of Ambient Stations in Lakes Washington, Sammamish, and Union that Met the Fecal Coliform Bacteria Standard, 2000–2008

Overall Quality in Major Lakes—Trophic State Index

Samples are collected to assess overall water quality in Lakes Washington, Sammamish, and Union from both the mid-lake (open water) and nearshore locations biweekly in the summer and monthly during the rest of the year.

Overall water quality is determined by measuring the summer (June–September) total phosphorus (TP) concentrations and converting them to the trophic state index TSI-TP). The TSI-TP relates phosphorus to the amount of algae that the lake can support. The potential for nuisance algal blooms is considered low if the TSI-TP is less than 40, moderate if less than 50, and high if greater than 50. High algae productivity often relates to poor water quality. Although such high productivity may not reduce beneficial uses in all cases, depending on the natural condition of the lake, a trend toward increased TSI-TP could indicate changes in the watershed.

TSI-TP results vary from year to year, depending on climate and biological interactions that create unique annual conditions in each lake (Figure C-14). The 1994–2008 results for Lakes Sammamish and Washington show that phosphorus concentrations fluctuate between the low and moderate thresholds from year to year, indicating that water quality varies from good to moderate with a low potential for nuisance algal blooms. Lake Union typically shows phosphorus concentrations in the moderate water quality range, with the exception of 2007 when high phosphorus levels put Lake Union in the poor water quality range.

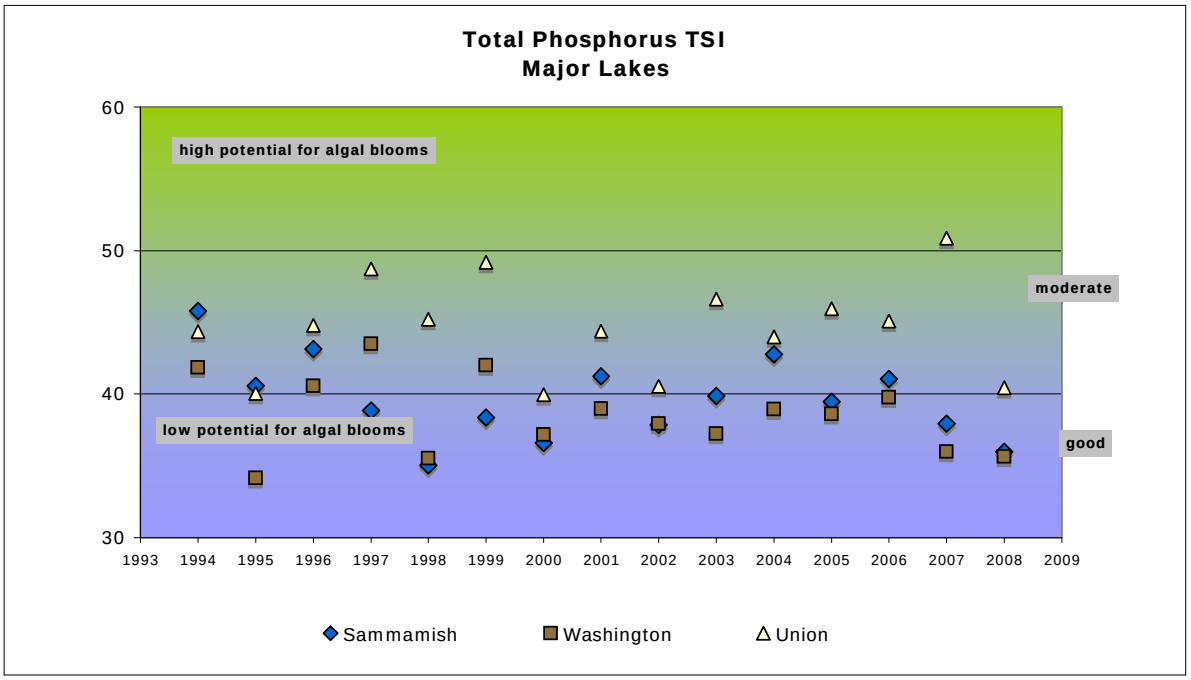

Figure C-14. Overall Water Quality in Lakes Washington, Sammamish, and Union Based on the Trophic State Index for Total Phosphorus, 1994–2008

Water Temperature—Effects of Climate Change

Global climate change is having an impact on our local weather patterns and subsequently on county aquatic resources. On average, ambient air temperatures in the Pacific Northwest have increased over the twentieth century by roughly 1.5ºF.[13] Air temperatures in the region are expected to continue to increase by another 2ºF to 9ºF over the next 80 years.

Lake temperatures vary annually, depending on seasonal weather conditions (wind, precipitation, cloudiness, and ambient air temperatures). Warmer air temperatures have reduced the snow pack levels in Washington and, thus, the timing and quantity of flows in regional rivers and streams. Higher air temperatures and changes in wind patterns also increase lake temperatures through surface heat exchange processes.

The University of Washington has routinely measured temperatures in Lake Washington since 1957. King County (then Metro) began monitoring temperatures in Lakes Washington, Sammamish, and Union in 1979. Additional Lake Washington data were collected in 1913, 1933, and 1950–1952. Water temperatures are taken during January because the lakes are well mixed during this month and temperatures at the surface reflect the temperatures throughout the water column water. Temperatures are measured at a 1-meter depth from the mid-lake monitoring stations.

Overall, winter water temperatures have increased about 0.25°C (0.45°F) per decade since 1960 in Lake Washington and about 1°C (1.8°F) per decade since 1979 in Lakes Sammamish and Union (Figure C-15). The smaller increase in Lake Washington is likely due to its larger volume, which is roughly 8 times greater than Lake Sammamish and 118 times greater than Lake Union.

[13] For more information on climate in the Pacific Northwest, see the University of Washington's Climate Impacts Group Web site at http://www.cses.washington.edu/cig/pnwc/pnwc.shtml.

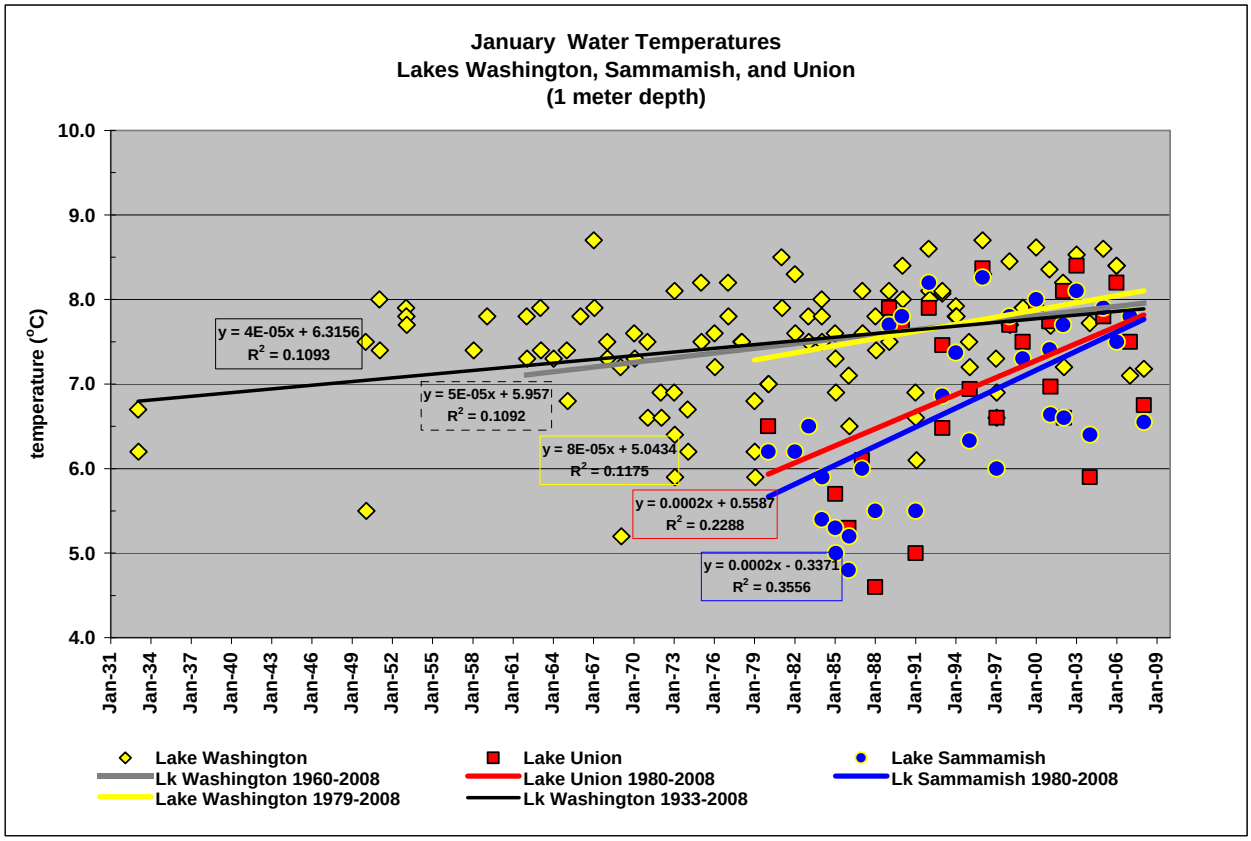

Figure C-15. January Water Temperatures in Lakes Washington, Sammamish, and Union, 1933-2008

Swimming Beaches

Fecal coliform bacteria can enter lakes from untreated wastewater effluent, household or farm animals, wildlife, stormwater runoff, wastewater overflows, or failing septic systems. The most affected beaches are adjacent to streams that drain urbanized drainage basins. Samples are collected for fecal coliform bacteria each week between Memorial Day and the end of September at 17 swimming beaches in Lake Washington, Lake Sammamish, and Green Lake (Figure C-16).

King County's standard for acceptable fecal coliform bacteria levels in swimming beaches is that none of the testing sites violates both parts of the Washington State Department of Health's fecal coliform bacteria target, which is the geometric mean of 200 colonies per 100 mL with no single sample exceeding 1,000 colonies per 100 mL. Public Health–Seattle & King County and the Washington State Department of Health currently use this standard, which is called the Ten State Standard.

In 2008, 100 percent of samples collected from Green Lake and Lake Sammamish met both parts of the fecal coliform bacteria standard (Figure C-17and Figure C-18). This is the sixth year in a row that all Green Lake samples have met the standard. Lake Sammamish results vary slightly from year to year in the same six years, showing percentages somewhere between the low 90s and 100. For Lake Washington, 94 percent of the samples, compared to 91 percent in 2007, met

the standard (Figure C-19). High bacterial counts were measured at five beaches monitored in Lake Washington: Juanita, Magnuson off-leash area, Gene Coulon, Matthews, and Luther Burbank. The high counts resulted in one swimming beach closure (Juanita) compared to four closures in 2007 (Juanita, Magnuson Off-Leash area, Gene Coulon, and Meydenbauer Bay). An intensive bacteria monitoring survey took place in the Juanita Creek basin in 2008 as a joint effort between King County, the City of Kirkland, and Ecology. Results of the survey will be published in 2009.

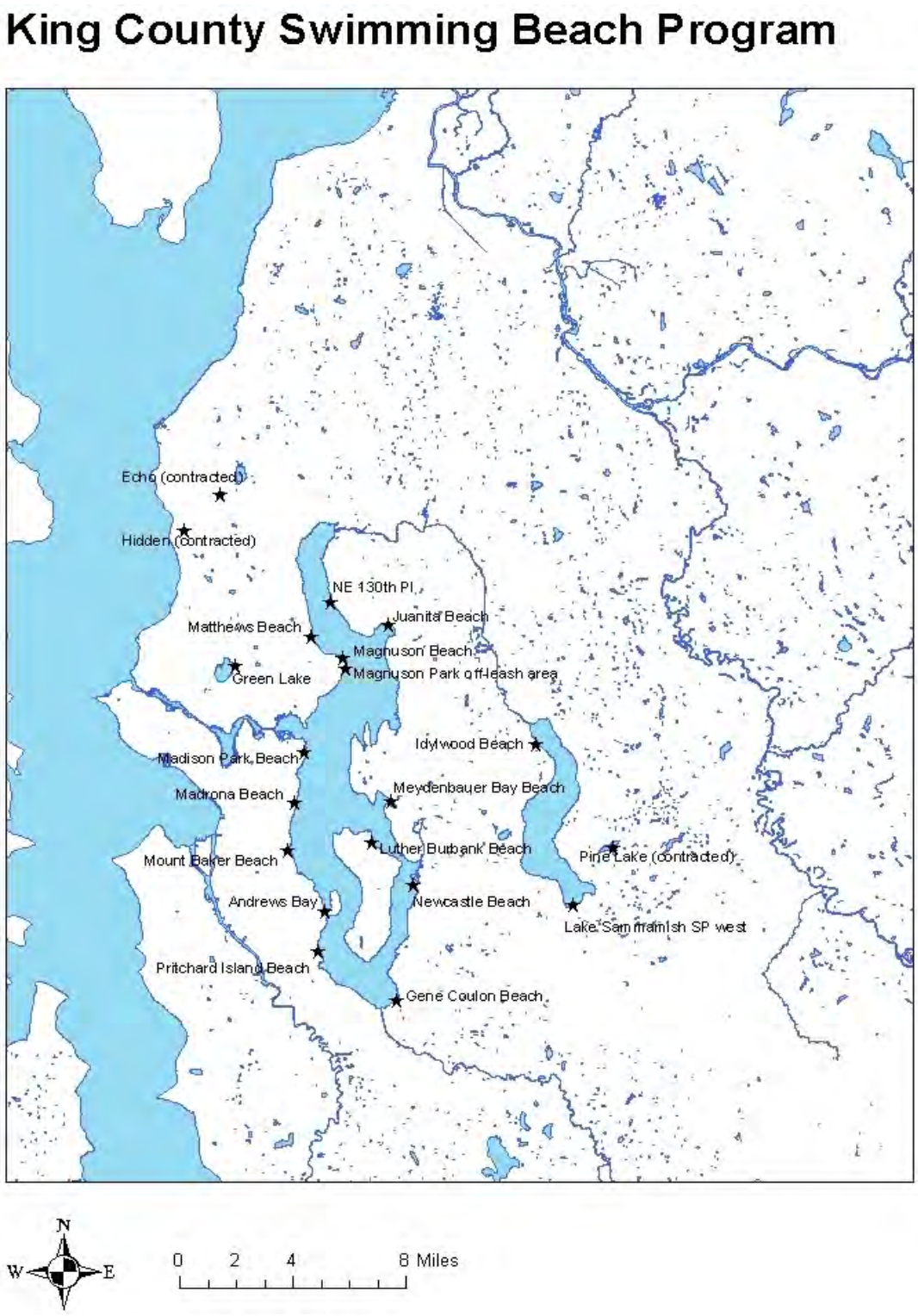

Figure C-16. Swimming Beach Monitoring Locations in Lake Washington, Lake Sammamish, and Green Lake

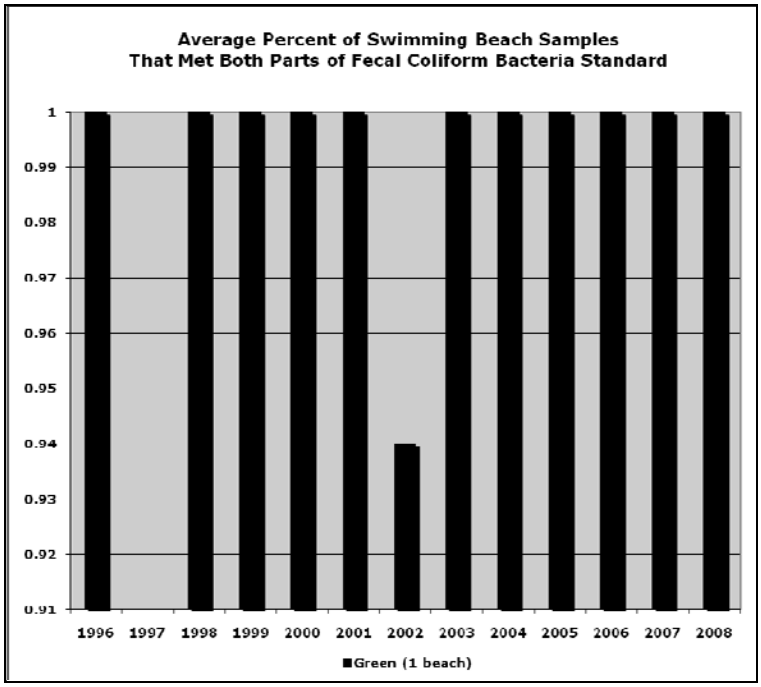

Figure C-17. Percentage of Samples that Met the Fecal Coliform Bacteria Standard at Green Lake Swimming Beaches, 1996–2008

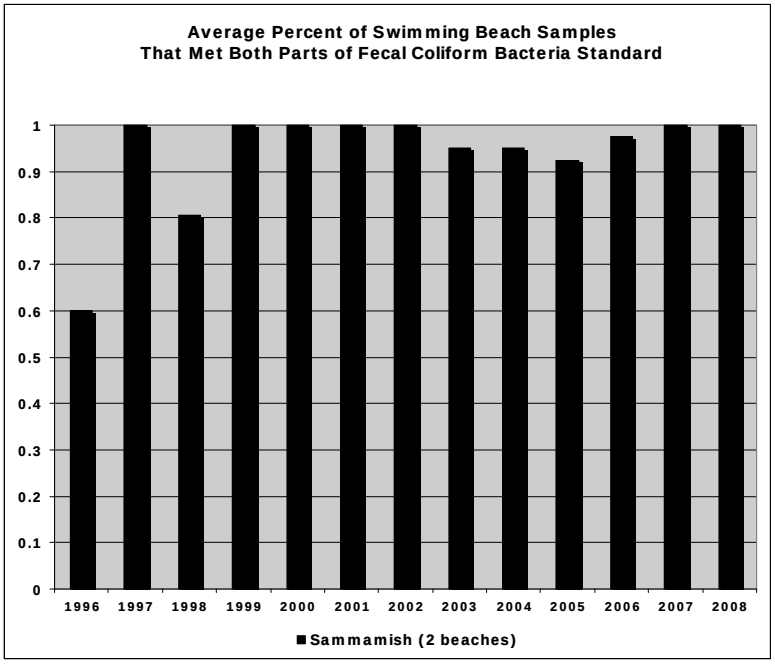

Figure C-18. Percentage of Samples that Met the Fecal Coliform Bacteria Standard at Lake Sammamish Swimming Beaches, 1996–2008

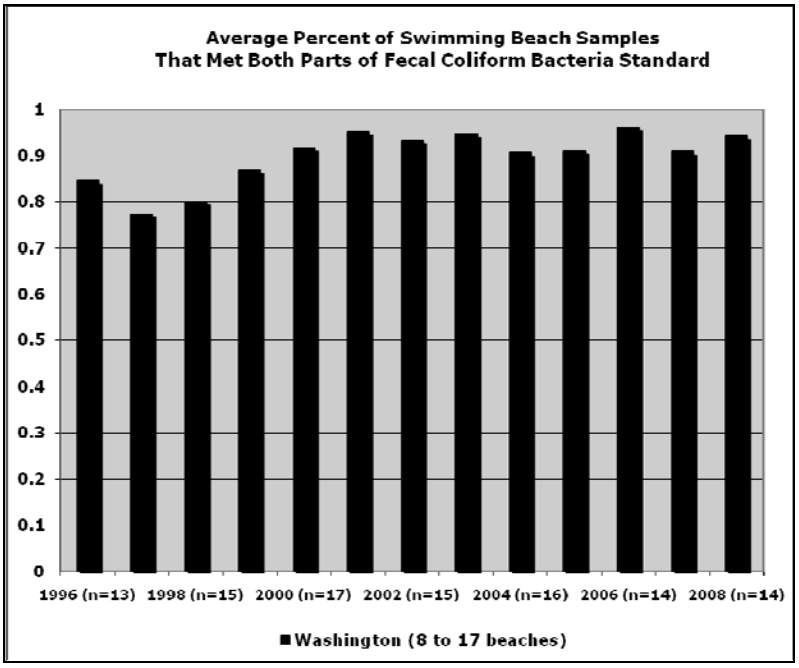

Figure C-19. Percentage of Samples that Met the Fecal Coliform Bacteria Standard at Lake Washington Swimming Beaches, 1996–2008

Major Lakes Sediment Monitoring Results

Sediment quality, along with indicators of water quality, habitat, and the aquatic food web (plankton, invertebrates, and fish), can present a picture of environmental health. Chemical contaminants that are washed into streams and lakes from urban areas can attach to sediments, settle to the bottom, and act as a record of both historical and recent discharge of contaminants into surface waters.

A 10-year lake sediment monitoring program began in 2007. The program incorporates a stratified sampling strategy. The strata include deep water stations, swimming beaches, nearshore habitat, and areas that previous studies have shown to be contaminated. A total of 20 sediment samples are collected each year: five samples for long-term trend monitoring from ambient stations in the deep main basins of Lakes Washington, Sammamish, and Union (Figure C-20) and fifteen one-time samples from the following locations:

- In the wading zone at public swimming beaches to better understand the public's exposure to sediment contaminants at swimming beaches
- In shallow non-developed shoreline areas to determine if contaminant levels are a concern in the nearshore terrestrial/aquatic habitat
- In areas where previous studies found contaminant levels above sediment quality guidelines. Sampling grids will be used to determine the spatial extent of contamination.

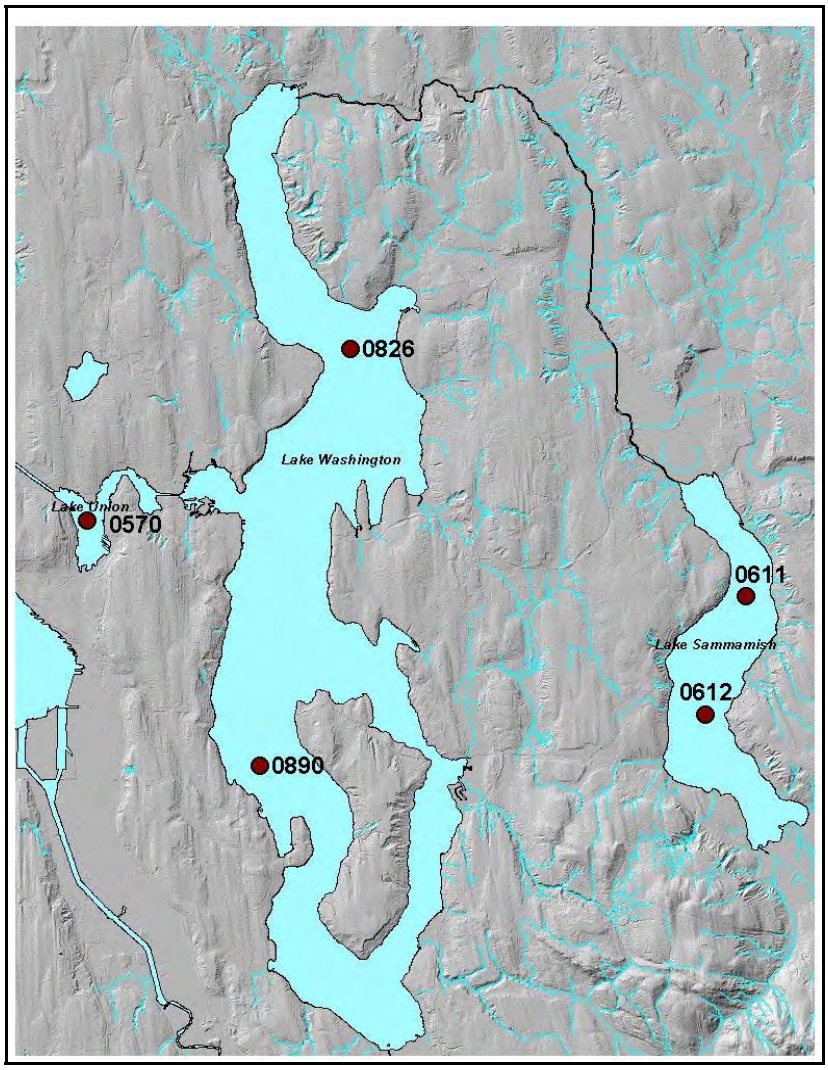

Figure C-20. Long-Term Sediment Monitoring Stations in Lakes Washington, Sammamish, and Union

Samples are analyzed for metals, organics, and physical parameters, and results are compared to sediment quality guidelines, including Ecology's floating percentile guidelines and guidelines developed as part of the International Association for Great Lakes Research, to understand their effect on aquatic life.[14]

In 2007, sediment samples from 18 locations (16 one-time locations—including a replicate—and 2 long-term locations) in Lake Sammamish were collected and analyzed. Results indicated that in 10 locations, chemical concentrations were high enough to suggest that adverse effects to

[14] Smith, S. S., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. *J. Great Lakes Res.* 22(3): 624-638. Internat. Assoc. Great Lakes Res.
Washington State Department of Ecology and Avocet Consulting. 2003. Development of freshwater sediment quality values for use in Washington State. Phase II Report: Development and recommendation of SQVs for freshwater sediments in Washington State. Washington State Department of Ecology, Olympia, WA.

aquatic organisms are likely. Concentrations in four locations were at a level where effects are uncertain, and concentrations in the last four locations suggest that effects are unlikely. Additionally, polybrominated diphenyl ethers (PBDEs) were detected in several locations associated with storm drains. The locations and concentrations of these chemicals suggest that further study is needed to determine their sources and their effects on the aquatic community present in these lake sediments.

In 2008, sediment samples were collected from 17 locations in Lake Washington. Data are not yet available on the 2008 sampling.

Stream and River Water Monitoring Results

This section describes the quality of water in King County streams and rivers in terms of overall water quality (water quality index) and normative streamflows.

Overall River and Stream Water Quality—Water Quality Index

Fifty-six sites along rivers and streams in WRIAs 8 and 9 (Cedar-Sammamish and Green-Duwamish watersheds) have been sampled monthly, some for over 30 years.[15] Numerous water quality parameters are monitored, including those used to determine the WQI. Samples are collected monthly under base flow conditions and four times each year at the mouth of streams under storm conditions. Figure C-21 shows the locations of these sites and of seven sites on Vashon–Maury Island that were sampled in 2008 and included in the calculation of the WQI.

The WQI for rivers and streams integrates a series of key water quality indicators into a single number that can be used for comparison over time and among locations. The WQI is based on a version proposed by Ecology and originally derived from the Oregon water quality index. It is a number ranging from 1 to 100—the higher the number, the better the water quality. For temperature, pH, fecal coliform bacteria, and DO, the index expresses results relative to state standards required to maintain beneficial uses. For nutrient and sediment measures, where the state standards are not specific, results are expressed relative to expected conditions in a given eco-region. Multiple constituents are combined, results are aggregated over time to produce a single score, and a rating of low, moderate, or high concern is assigned for each sampling station.

[15] The number of sites included in the routine monitoring will be reduced to 20 starting in 2009 because of budget cuts.

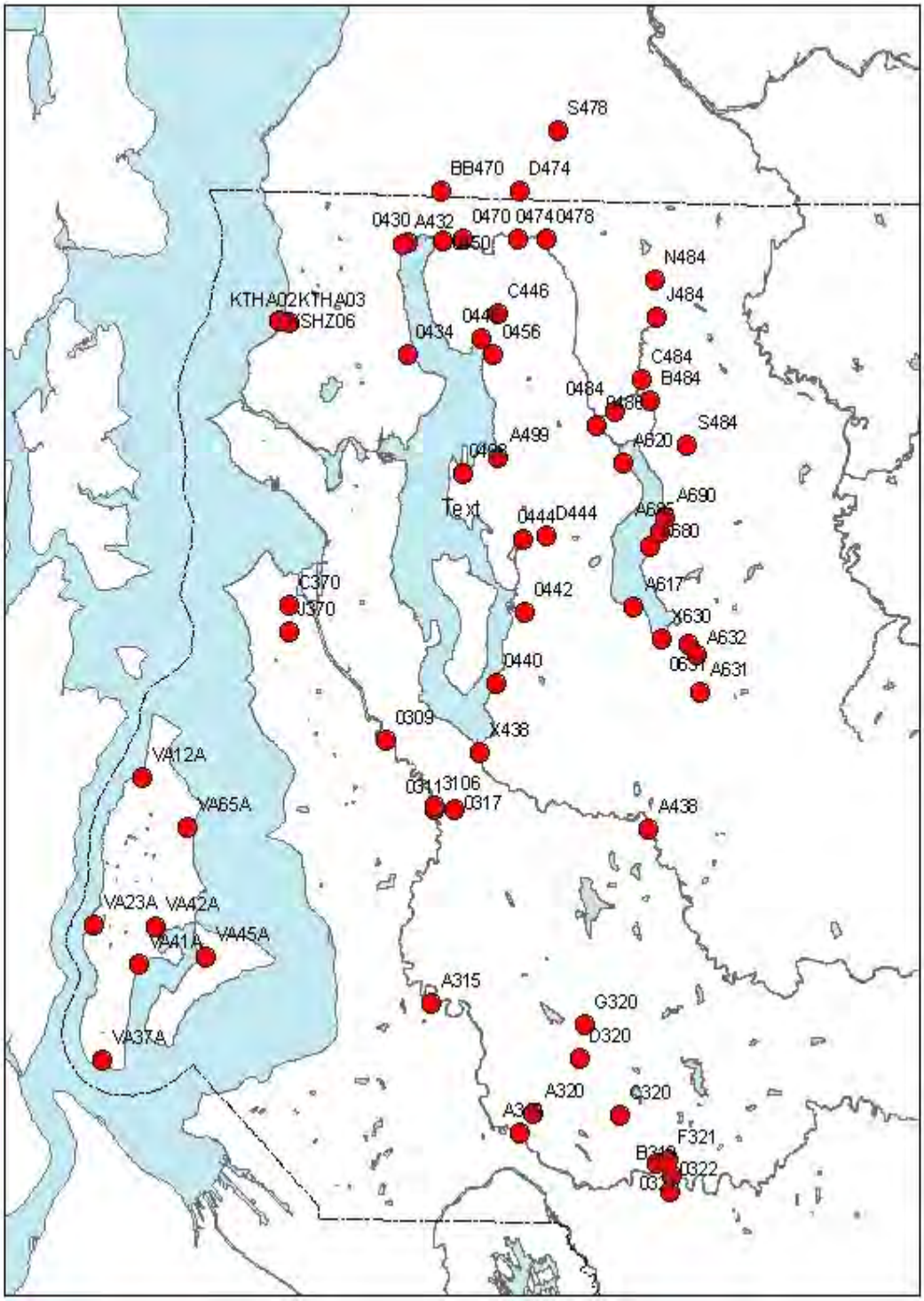

Figure C-21. Monitoring Locations in Rivers and Streams in 2008

Overall water quality in King County streams varies between and within streams, reflecting the effects of a population of almost two million residents and intense urbanization. Increased development and greater volumes of stormwater runoff have impacted and continue to impact the water quality of rivers and streams in the county. During the 2007–2008 water year (October

1 through September 30), cumulative rainfall was below average compared to historical values, even with an exceptionally wet December. As a result, WQI scores were better than in previous years. In contrast, cumulative rainfall in the 2006–2007 water year was well above historical averages and the year showed the highest percentages of "high concern" ratings in the period from 2000 through 2008.

In the 2007–2008 water year, 57 percent (36 sites) of the 63 sampling sites were rated of moderate concern and 24 percent (15 sites) were of high concern (low water quality) (Figure C-22). Of the 23 sites in WRIA 9, 8 sites were rated of low concern, 13 sites were of moderate concern, and 2 sites were of high concern (Figure C-23). Of the 40 sites in WRIA 8, 4 sites were rated of low concern, 23 sites were of moderate concern, and 13 sites were of high concern (Figure C-24).

On occasion, extreme storms occur during routine sampling events. WQI ratings are calculated with these dates excluded to allow for year-to-year comparisons of routine events. Figure C-22 shows the percentages both with and without the extreme storm events that occurred during sampling in the 2000–2001 and 2006-2007 water years to illustrate the impact of these events.

All samples that were rated of high concern in 2008 were affected in part by excessive nitrogen and/or phosphorous. In addition, almost all high-concern sites were affected by low DO (73 percent), high fecal coliform bacteria (67 percent), high temperatures (33 percent), and high-suspended solids/turbidity (13 percent).

Stormwater, waterfowl wastes, and pet wastes are the most likely sources of bacteria in urban streams. Poor livestock manure management and failing septic systems can be a potential source of bacteria in agricultural and suburban areas. In wetlands, wildlife excrement and stagnant water conditions can lead to elevated bacteria counts. High phosphorus concentrations are found in fecal material, and elevated concentrations of phosphorus are often linked to similar sources as bacteria. Elevated phosphorus concentrations are also linked to areas undergoing development. Low DO concentrations can be associated with low flows, wetlands, high temperatures (colder water holds more oxygen), and high levels of organic matter (bacteria use oxygen in the process of decomposing).

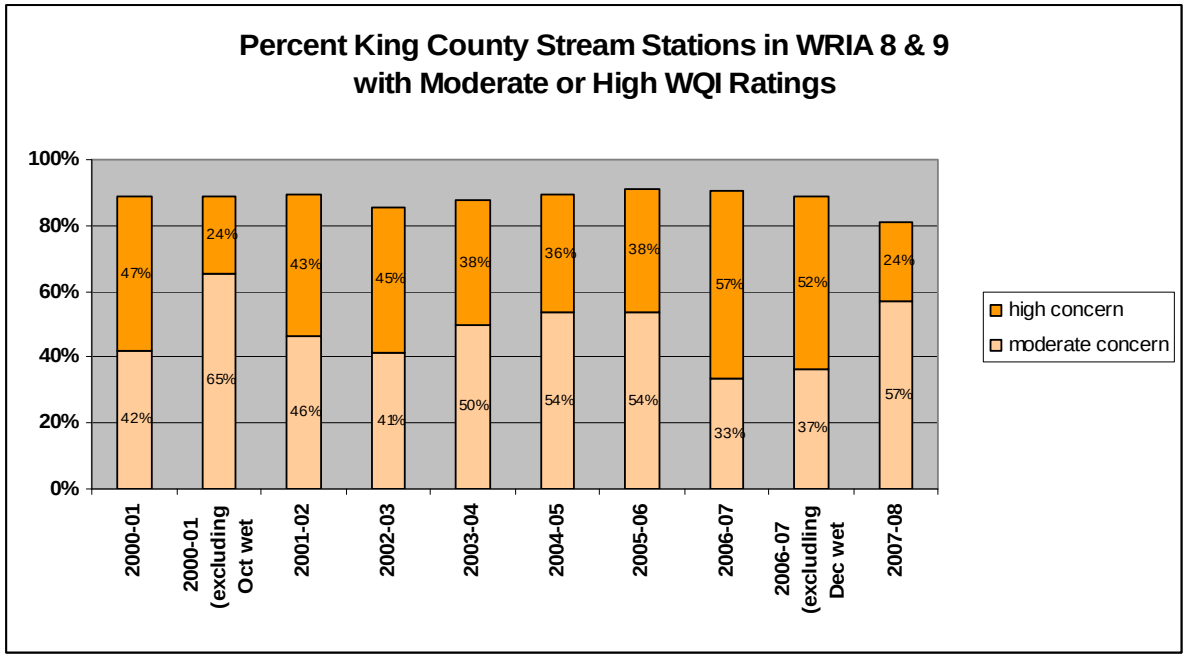

Figure C-22. Percentage of Streams in WRIAs 8 and 9 with High or Moderate Concerns Based on Water Quality Index, 2000–2008

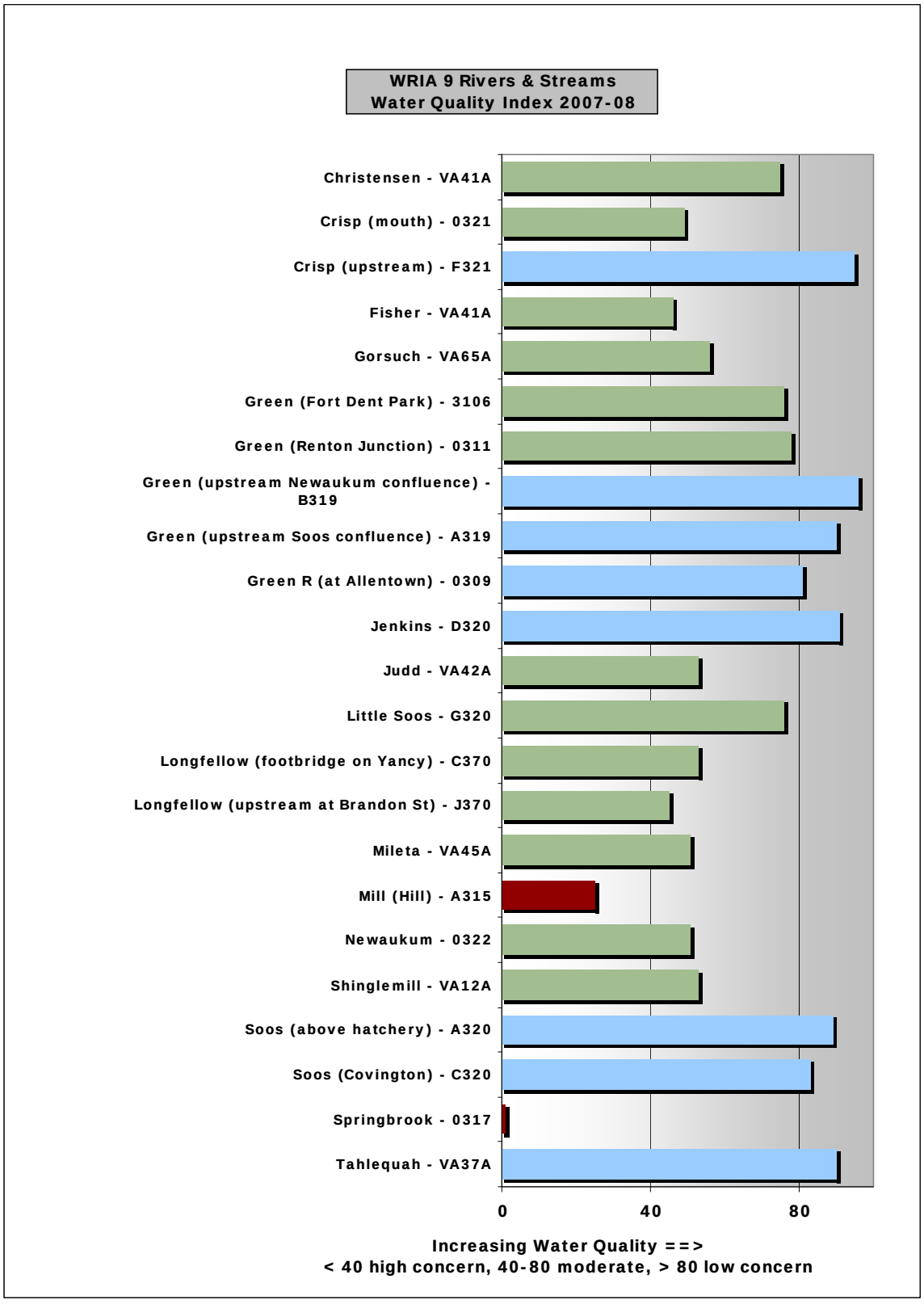

Figure C-23. Water Quality Index Rankings for Rivers and Streams in WRIA 9, 2007–2008

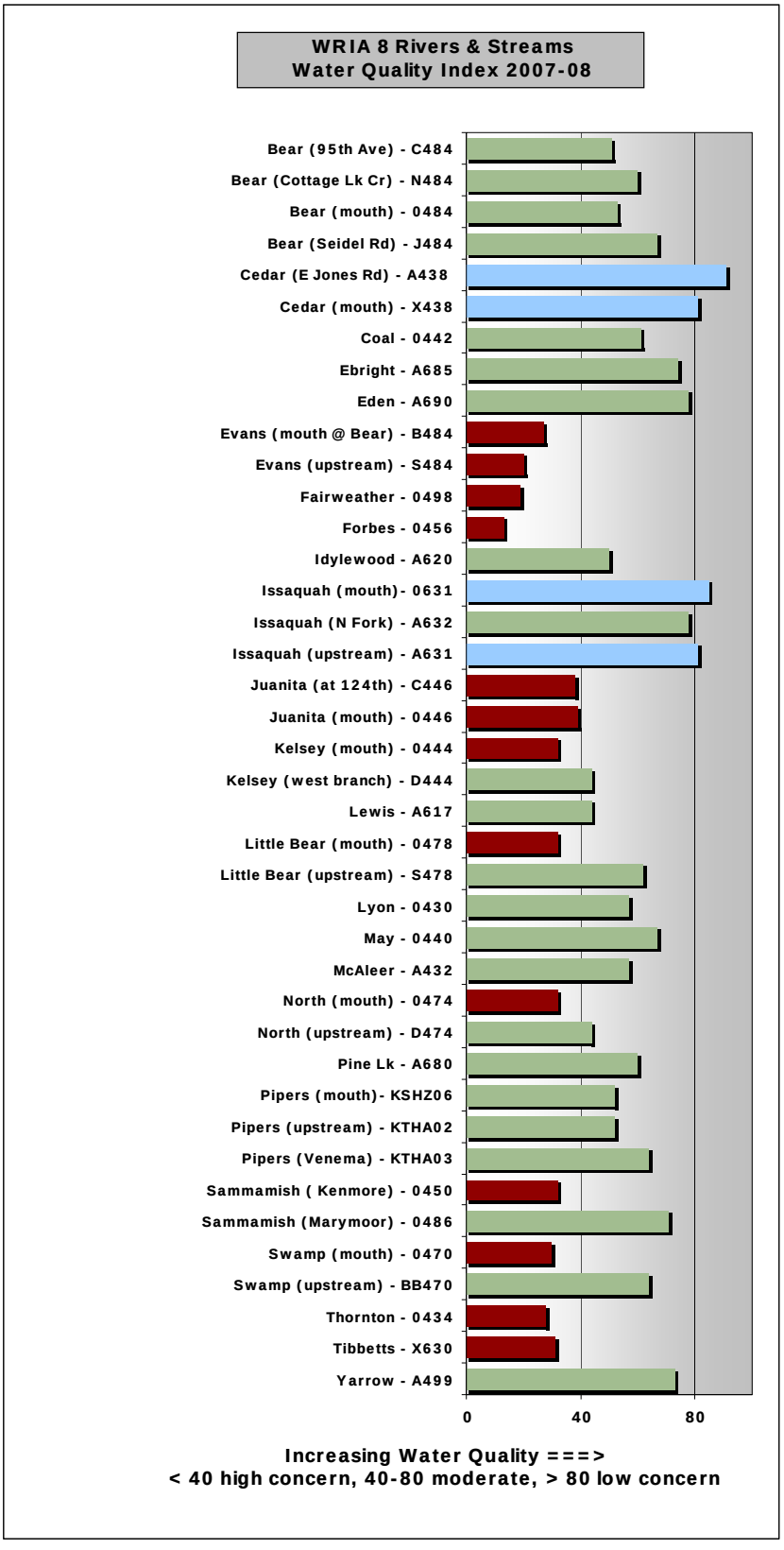

Figure C-24. Water Quality Index Rankings for Rivers and Streams in WRIA 8, 2007–2008

Normative Streamflows

Streams in urban areas respond more quickly to rainfall than streams in forested areas. Because less rainfall is being absorbed by vegetation and soil, more surface runoff occurs. Higher, more rapid, and frequent pulses of runoff ("flashiness") lead to flooding and channel erosion. From a biological perspective, streams with more frequent peak flows are disturbed more often. Organisms that survive in these conditions are those that have adapted to more frequent and severe disturbances (DeGasperi et al., 2009).[16]

Flows from twenty stream sites in King County, including five sites monitored by the U.S. Geological Survey, were measured and their flashiness calculated during the 2007–2008 water year (October 2007–September 2008) (Figure C-25). The "flashiness index" is based on the reciprocal of the fraction of days during the year that the flow rises above the annual mean daily flow. The stream flashiness index was also calculated for previous years using historical data. The number of streams where data were available ranges from one stream in 1941 to twenty-two streams in 2001. The median flashiness declined between 2006 and 2008, primarily from interannual variation resulting from variation in rainfall. In general, the median of the flashiness index scores across streams measured has increased between 1945 and 2008 (Figure C-26). These data suggest that increased urbanization has resulted in faster surface runoff and peak streamflow rise and fall (increased flashiness) than previously occurred in at least some streams.

[16] DeGasperi, C.L., H.B. Berge, K.R. Whiting, J.J. Burkey, J.L. Cassin, and R.R. Fuerstenberg. 2009. Linking hydrologic alteration to biological impairment in urbanizing streams of the Puget Lowland, Washington, USA. *Journal of the American Water Resources Association 45(2):*512-533.

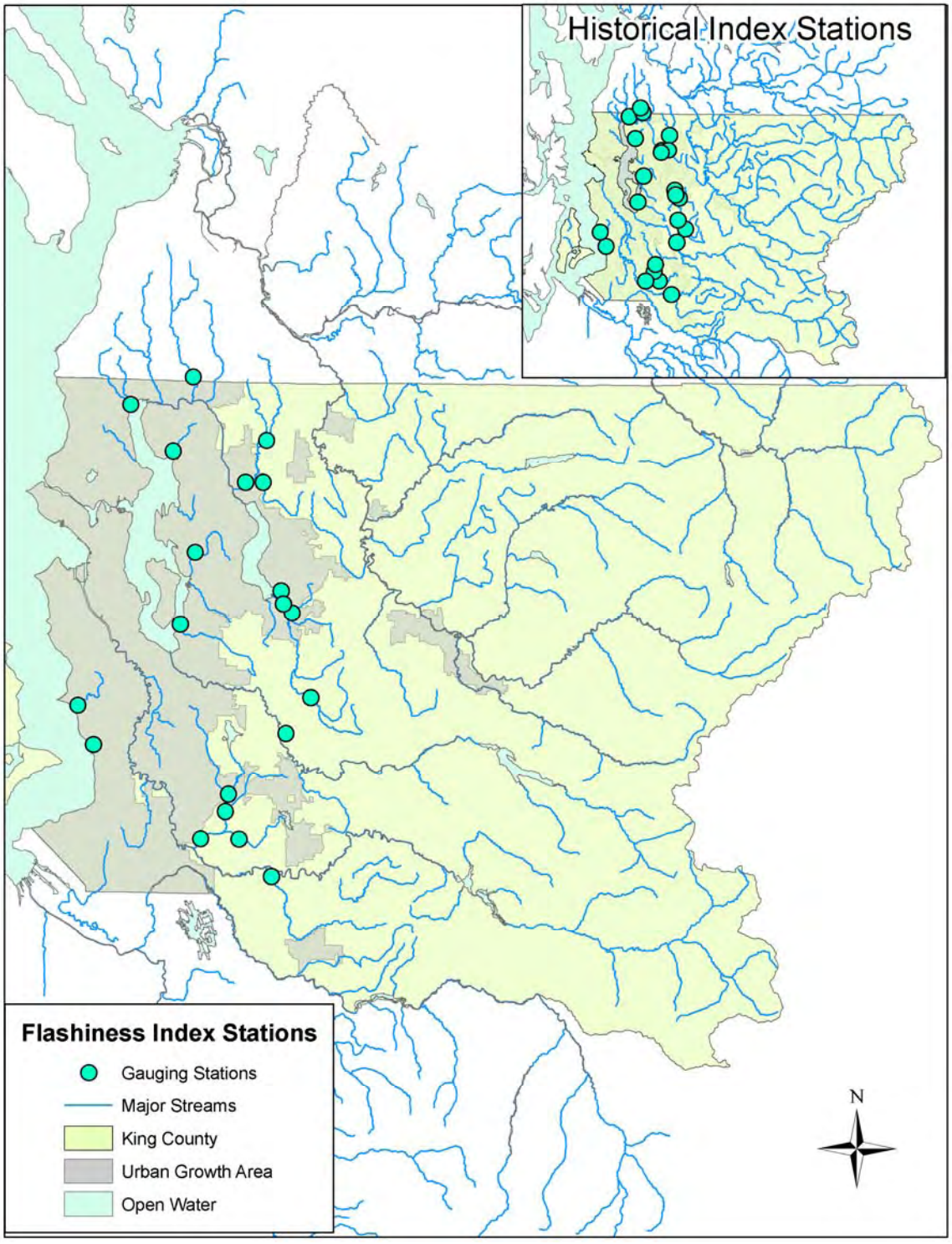

Figure C-25. Hydrologic Monitoring Stations Used to Calculate the Stream Flashiness Index, 1945–2008

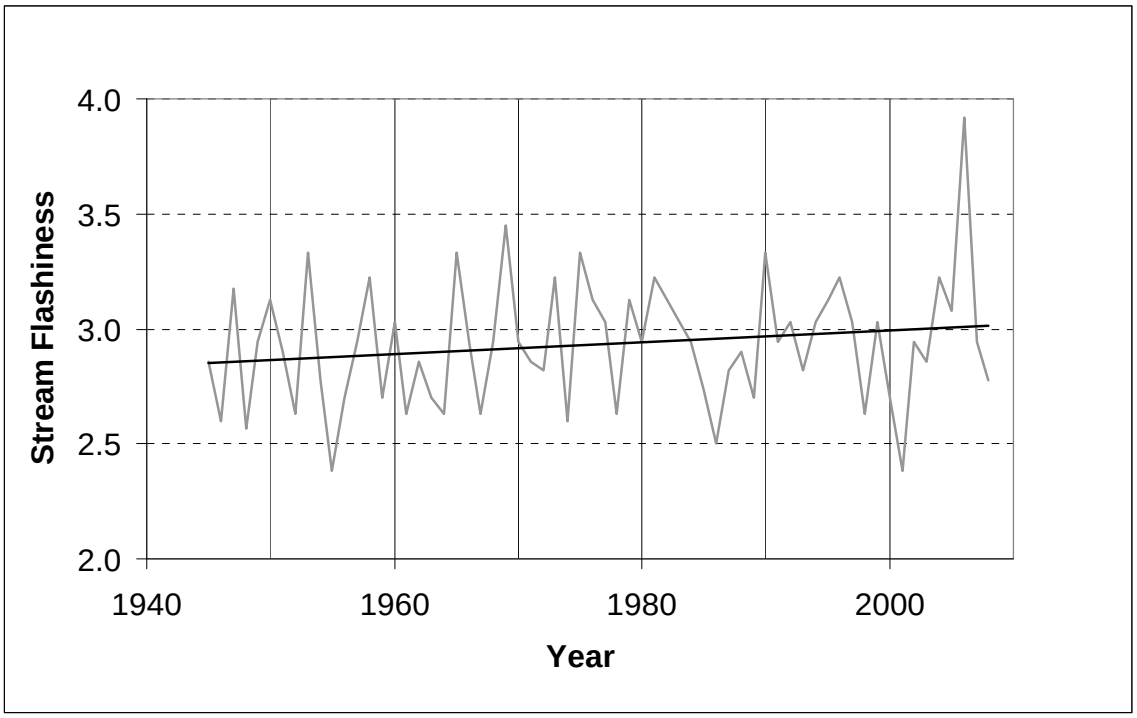

Figure C-26. Annual Median Stream Flashiness Index Scores, 1945–2008

Stream and River Sediment Monitoring Results

The Stream Sediment Monitoring Program began in 1987. Monitoring between 1987 and 2002 in WRIAs 8 and 9 found concentrations of several metals, including arsenic, cadmium, copper, nickel, and zinc, above available sediment quality guidelines. The data also showed elevated concentrations of petroleum hydrocarbons. Using these data and new information, the county began an updated 10-year stream sediment monitoring program in 2004. The updated program was designed to address data gaps identified during the original program, monitor the effects of pollutant sources (point sources, stormwater, and other urban discharges), achieve a better understanding of sediment quality in entire stream basins, and determine long-term trends.

Additional parameters were added to those monitored in the original program. Samples collected through the updated program are analyzed for metals, organics, and physical parameters. All parameters are compared to sediment quality guidelines, including Ecology's floating percentile guidelines and guidelines developed as part of the International Association for Great Lakes Research, to understand their effect on aquatic life.[17]

[17] Smith, S. S., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. *J. Great Lakes Res.* 22(3): 624-638. Internat. Assoc. Great Lakes Res.
Washington State Department of Ecology and Avocet Consulting. 2003. *Development of freshwater sediment*

For trend analysis, 10 small wadeable streams were selected from the original program, allowing for use of historical metal and conventional data. Samples are collected yearly. Trends will be evaluated when sufficient data have been collected over time. For stream basin analysis, one-time samples are collected along each mile of a stream to monitor the processes that affect sediment quality in WRIAs 8 and 9. Approximately, three streams are monitored each year. All 30 streams in the program will be monitored by the end of the 10-year program. So far, Thornton, McAleer, Lyon, Swamp, North, Little Bear, Juanita, Forbes, Bear, Evans, Cottage Lake, Kelsey, and Coal Creeks—all in WRIA 8—have been monitored. Data from this program along with data from lake sediment and fish tissue samples are beginning to form a picture of the fate and transport pathway of these persistent chemicals.

Samples were collected from 93 stations in King County streams between 2004 and 2007. Results from analysis completed in 2008 indicate that while sediments at 36 of the stations were likely having no adverse effects on sediment biota, concentrations exceeded at least one sediment quality guideline at the other 57 stations (Figure C-27). Of these 57 stations, 25 had concentrations low enough that the effects were uncertain and 32 had concentration that were likely having adverse effects.

Chemicals that exceeded guidelines include metals, PAHs, and bis-2-ethylhexyl phthalate. Other chemicals that exceeded guidelines were organochlorines, including PCBs and banned insecticides such as DDT, DDD, DDE (DDD and DDE are byproducts of DDT), chlordane, and dieldrin. The presence of these organochlorines shows that chemicals can persist in the environment decades after being banned. These types of chemicals can accumulate in aquatic organisms and be taken up by organisms that are higher in the food chain (larger fish). A current advisory suggests limiting the consumption of some types of fish from Lake Washington because of high levels of some of these contaminants.

Samples collected in Issaquah, Springbrook, May, and Taylor Creeks in 2008 are still undergoing analysis.

quality values for use in Washington State. Phase II Report: Development and recommendation of SQVs for freshwater sediments in Washington State. Washington State Department of Ecology, Olympia, WA.

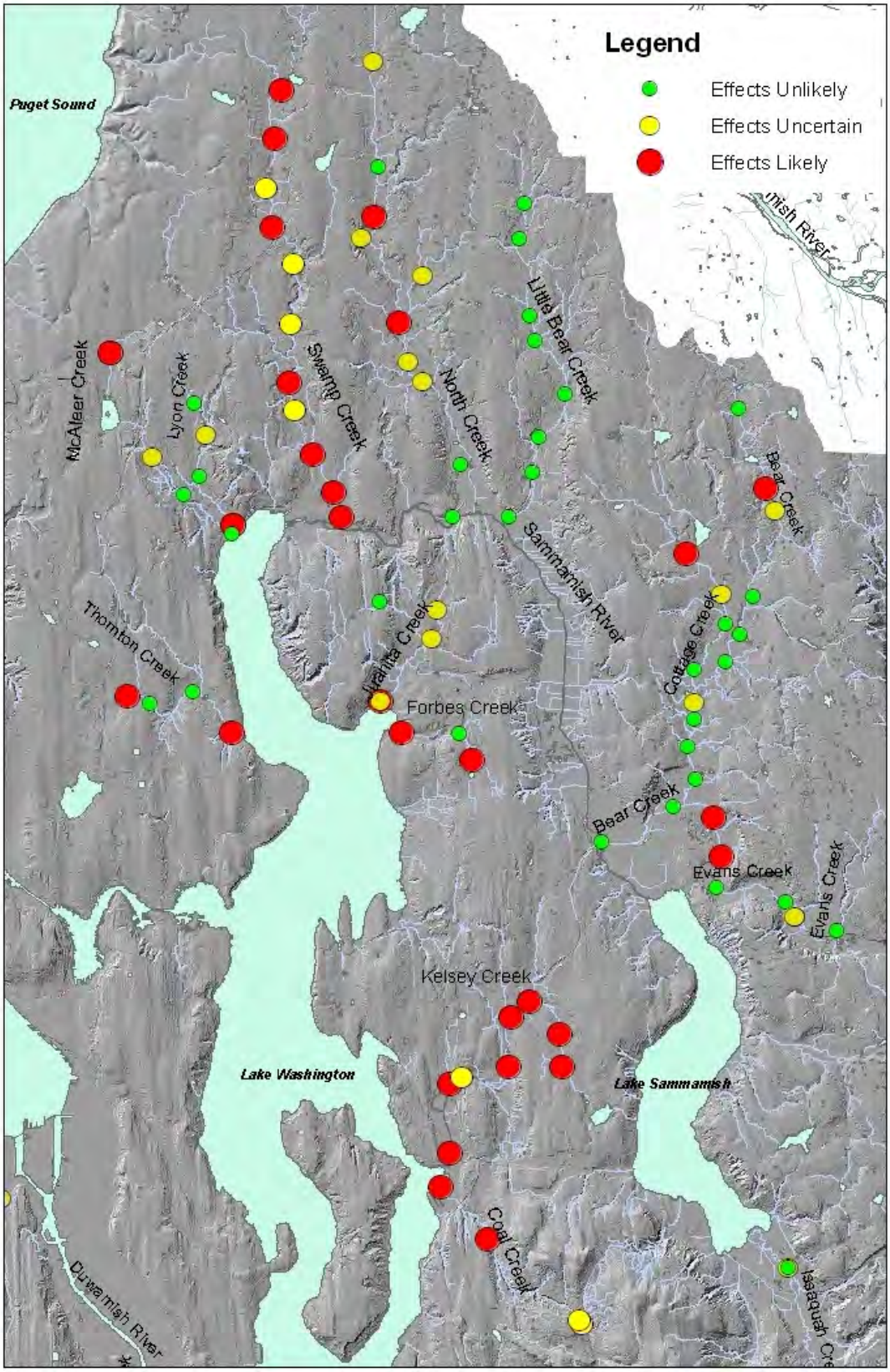

Figure C-27. Stream Basin Sediment Sampling Results, 2004–2007

Wetland Monitoring for Carnation Treatment Plant Discharge

King County's Carnation Treatment Plant uses membrane-bioreactor technology to produce reclaimed-quality water. In early 2009, the treatment plant will begin to discharge effluent to a wetland at the Chinook Bend Natural Area just north of the City of Carnation.

Enhancements were made to the wetland in preparation for discharge. As part of its reclaimed water use permit application to the Washington State Departments of Ecology and Health, the county collected samples in 2006 to establish water and sediment quality at the wetland site before the enhancements. Water samples were collected twice in 2006, once during the summer dry season and once during the winter wet season at three locations: where surface water enters the wetland, in the middle of the open-water pond, and where water flows out of the wetland. Sediment samples were collected during the summer from the central area of the open-water pond, the shoreline of the pond, and the wet soils where groundwater is seeping into the pond. All samples were analyzed for organics, metals, and physical parameters. Data analysis results were reported in 2007.

Post-enhancement water samples were collected twice in 2008, once during the summer dry season and once during the winter wet season. Samples were collected at two locations: in the open-water pond and where the water flows into a new flow control structure that was installed as part of the wetland enhancement program. No sediment samples were collected in 2008. All samples were analyzed for the same organics, metals, and physical parameters as before. These parameters will be monitored again in 2009 and beyond to look for trends or any changes that may provide information on using reclaimed water to enhance wetlands for ecological benefit. Analysis and interpretation of data from both post-enhancement and post-discharge sampling will occur after post-discharge sampling has been completed.