

# King County Water Quality Report

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For streams and water bodies that are or could be impacted by wastewater influent, effluent, sanitary system overflows, or combined sewer overflows

King County  
Department of Natural Resources

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# Executive Summary

This first annual King County Water Quality Report details the county's efforts in 2000 to protect and preserve water quality for Puget Sound and the major lakes and rivers.

In November 1999, the King County Council adopted the Regional Wastewater Services Plan (RWSP), a supplement to the King County Comprehensive Water Pollution Abatement Plan (Ordinance 13680). In December, the Council then adopted the RWSP Operational Master Plan (OMP). This report satisfies the requirements outlined in the OMP for an annual plan review to, "ensure that the RWSP reflects current conditions...and address[es] water pollution abatement, water quality monitoring results, water conservation and water reclamation, ESA compliance, septic system conversions to the regional sewer system, biosolids management, wastewater public health problems, compliance with other agency regulations and agreements."

This report deals primarily with streams and water bodies that are or could be impacted by wastewater influent, effluent, sanitary system overflows, or combined sewer overflows.

## State of the Waters

The general quality of major water bodies in King County is good, with negative impacts being seen in specific areas, such as some streams, fish habitat and sediments. Lake Washington's hydrology, water quality and habitat continue to be impacted by intense development. Similarly, Lake Washington can be characterized as having moderate to good water quality, however pollution generated by land use activity is of concern, especially since its surrounding area has some of the highest rates of development in the region. Lake Union has good to moderate water quality but its heavy urbanization and commercial use limits the amount of habitat available to fish.

The marine waters of Puget Sound's main basin are in excellent condition. However, results from routine monitoring of bacteria levels at some marine beaches and sediment quality in Elliott Bay and the surrounding developed waterfront exceed Washington State water quality criteria.

Water quality in the Green River and its tributaries varies widely depending on location in the watershed, level of urbanization and human activities. Numerous streams throughout the Green-Duwamish watershed are listed on the state's most recent list (1998) of water bodies that do not meet water quality standards. The Sammamish River is on the Washington Department of Ecology's most recent list (1998) of water bodies that do not meet state water quality standards. Changes in various water quality elements, such as temperature and oxygen levels, are significant issues that are of concern to salmon conservation efforts in these rivers.

## Wastewater Treatment Facilities

The King County Wastewater Treatment Division's mission is to protect public health and the environment. Serving approximately 1.3 million residents, the county moves wastewater from homes and businesses served by local agencies to two large regional treatment plants. The quality of effluent remained high in 2000 for both the West Point Treatment Plant and South Treatment Plant. The Vashon Treatment Plant's history, prior to the county assuming

operation, included numerous National Pollutant Discharge Elimination System (NPDES) permit violations. However in 2000, the Vashon facility had only five permit exceptions.

### **Water Quality Monitoring Programs**

To protect its significant investment in water quality improvements, King County continuously conducts extensive monitoring programs to assess marine waters, lakes, rivers and streams. In July 2000, a new automated water sampling system was launched, installing five robotic sampling stations to monitor Lake Sammamish and Lake Washington 24 hours a day, seven days a week, as part of the Sammamish Washington Assessment and Modeling Program (SWAMP). This high-tech method of sampling will increase both the efficiency and amount of data collected and is an example of the county's commitment to finding innovative ways to address the growing need for information about our aquatic environment.

The marine monitoring program routinely evaluates nutrient, bacteria and dissolved oxygen levels in the waters of the main basin of Puget Sound as well as monitoring sediment quality near outfalls and at ambient locations. The Marine Outfall Siting Study (MOSS) is an exhaustive investigation of water quality in northern Puget Sound that will help evaluate potential sites for the Brightwater treatment facility's marine outfall.

Monitoring of bacterial pollution at county fresh water swimming beaches is also done to assess risk to human health. There were fewer beach closures in 2000 than in years past, with only two swimming beach closures, which were associated with waterfowl fecal matter and not the result of a sewage overflow event.

### **Water Quality Management Programs**

Treating wastewater using high standards and constant system improvements is one way the county protects water quality. Another is by looking ahead to develop programs that use prevention to keep pollutants from even reaching our treatment plants. For example, in 2000 the Local Hazardous Waste Management Program in King County collected 1,600 tons of household hazardous waste for safe disposal, preventing this waste from going directly into drainage systems or landfills. The Integrated Pest Management Program reduced total pesticide use by the county in 2000 by 51 percent. In 2000, the Industrial Waste Program, which regulates industrial wastewater discharges, collected 2,683 samples, 274 of which were in violation of discharge regulations. All violations were followed up with some form of enforcement action.

### **Upcoming Issues**

In 2001, King County will respond to the listing of chinook salmon under the Endangered Species Act (ESA) by working with the National Marine Fisheries Service to develop guidelines that will allow our wastewater treatment operations to work within the framework of ESA's 4(d) rule to protect salmon. The ESA listing may also encourage uses of reclaimed water. In 2001, the county will implement a pilot demonstration project on water reuse.

King County is also reviewing potential changes to state-mandated surface water quality standards and procedures as well as federal water quality standards for pollution that may become effective in 2001. These new rules, and the list of impaired county water bodies according to the state, will require additional attention to water quality data collection and modeling in the near future to ensure our ability to keep King County waters clean.

# 2000 Water Quality Survey

## Results

In November 2000, King County commissioned a telephone survey of 400 county residents, over the age of 18, selected at random (Evans/McDonough Company, 2000). The key findings were as follows:

- Almost all King County residents feel protecting water quality in King County is important and most think it is extremely important.
- Almost half of the residents surveyed agree that water quality is improving in area lakes, rivers, streams and in Puget Sound, and a majority of residents give King County a positive rating for the job it does protecting water quality.
- A majority of residents who pay a sewer bill say they would be willing to pay more to further protect water quality in the region.
- After hearing an explanation of reclaimed wastewater most residents favor using reclaimed wastewater for a variety of purposes and most agree that they would use reclaimed water to water their lawn.
- Although awareness of the county's plans for future sewage treatment facilities continues to be low, most residents are not opposed to having a new facility in their area. Residents' top concerns about a new facility are environmental/safety concerns and odor.
- A majority of residents have at least some idea of what a watershed is, but most do not know what watershed they live in.
- Almost all residents see a direct link between water quality and the health of salmon.
- When asked how the county can improve its efforts to protect water quality, the top response was "education/increase awareness," and most residents believe that water quality education is a good use of public money.

# State of the Waters

In the Puget Sound region, water is an integral part of our surroundings, economy and way of life. As it flows through our environment, water takes on characteristics of its surroundings. Over time, small changes may add up to big impacts in water quality. King County acts as a steward of these waters and is committed to keeping it clean. Today, the quality of our waters has improved dramatically as a result of a cooperative effort by federal, state, tribal and local governments to implement the pollution control programs established by the Clean Water Act.

## Lake Washington

At 21,500 acres and 13 miles long, Lake Washington is the largest of the three major lakes in King County and the second largest natural lake in the State of Washington. The average depth of the lake is 108 feet; it is 214 feet at its deepest point. The lake is the prime rearing habitat for juvenile salmon spawned in the Cedar and Sammamish rivers. It provides multiple recreational opportunities, acts as a beautiful open space, and supports a number of resident fisheries. At the same time, the hydrology, water quality and habitat in and around the lake have been and continue to be impacted by development.

### General Conditions

Standard measurements for lake water quality are water clarity, algae or algal productivity (measured as chlorophyll  $\alpha$  - a plant pigment), and phosphorus (the primary nutrient responsible for algal growth). Measurements for the summer of 2000 remain in the moderate to good water quality range. The exception was a sample collected in June, which had relatively high chlorophyll  $\alpha$  and phosphorus concentrations, and lower water clarity. Based upon these standard parameters, Lake Washington can be characterized as having low productivity, or good water quality. However, Lake Washington continues to be listed by the state Department of Ecology as impaired due to fecal coliform. In addition many streams in the Lake Washington watershed exceed water quality standards.

### Sediments

Though representing a very small percentage of the lake's shoreline, several areas of sediment contamination exist in Lake Washington, under the Sediment Management Standards, and are under active clean-up orders by the state Department of Ecology.

## Lake Sammamish

Lake Sammamish is the sixth largest lake in Washington and the second largest in King County. It is a major lake for recreational users such as fishermen, boaters, water skiers, swimmers and picnickers. But just as importantly, it provides rearing and migratory habitat for multiple salmon species and a home for a variety of warm water fish, birds and other wildlife.

There is no single source of pollution coming into Lake Sammamish. Instead, the pollutant of concern - phosphorus - comes from runoff generated by a variety of sources and is called non-point source pollution. It is generated by almost every land use activity in the watershed: forests, logging practices, farms, homes, gardens, construction sites, natural erosion processes, stormwater runoff, commercial developments, car washing, septic tanks, and more. The water quality is being threatened by continuing development in the watershed. While the lakeside development is not nearly as concentrated as in lakes Union and Washington, Lake Sammamish is currently experiencing some of the highest rates of development within its watershed in the region.

### General Conditions

Lake Sammamish water clarity in the summer of 2000 exceeded the goal of 4.0 meters (as established in the Lake Sammamish Management Plan) with an average clarity of 4.6 meters. However, the lake did not meet the goal for reduced algal productivity established in the plan. Overall, water clarity was good to moderate, algal concentrations were moderate, and nutrient concentrations were low. Based upon these three standard parameters, Lake Sammamish can be characterized as having low to moderate productivity, or good to moderate water quality. The state Department of Ecology also lists Lake Sammamish as impaired due to fecal coliform levels.

### Sediment Study

King County is currently completing a comprehensive sediment quality evaluation of Lake Sammamish. The primary study objectives are to: (1) conduct a baseline sediment quality evaluation; (2) evaluate contaminants of concern; (3) evaluate sediment toxicity; and (4) evaluate stream bug community structure and compare these data with sediment toxicity results. This project is part of a much larger effort, the SWAMP (see section on *Major Lakes Monitoring*), that will provide a comprehensive evaluation of current and future water and sediment quality in the greater Lake Washington watershed.

Sediments collected from 16 locations throughout the lake were analyzed. In general, the highest levels of sediment-associated contaminants were found in the vicinity of stormwater discharges and at deep lake locations. A number of metals and organic compounds were found to exceed the sediment guidelines throughout the lake. However, toxicity test results suggest sediment associated contaminants are having adverse impacts in only a few select areas.

## Lake Union

Lake Union, at 580 acres and averaging 34 feet in depth, is unique among the three major King County lakes in that it is actually part of a heavily urbanized, man-made channel whose watershed drains residential, commercial and industrial neighborhoods. Its shores are completely lined by marinas, houseboat moorage, commercial docks, dry-docks and industries. Extensively altered by the Fremont and Montlake cuts and the Hiram M. Chittenden Locks, the main inflow is now from the Lake Washington Ship Canal and the main outlet is via the locks.

### General Conditions

Lake Union has historically been characterized as moderately productive, meaning it has moderate algal productivity. Measurements of water clarity, algae, and phosphorus taken in the summer of 2000 characterize Lake Union as having moderate to low productivity, or moderate to good water quality conditions. Lake Union is considered impaired by the state Department of Ecology for sediment and fish tissue.

The intrusion of salt water from the Ship Canal results in stratified lake conditions. The saline bottom water becomes devoid of oxygen early in the summer as bacteria consume the organically rich sediments at the bottom of the lake, limiting the amount of habitat available to fish. The lake and canal systems are the only migration route for the salmonids in the Lake Washington, Cedar River and Lake Sammamish drainage systems.

### Sediments

The state Department of Ecology completed a study to assess toxicity of sediments in Salmon Bay. Results confirmed contamination in many areas of the bay. Ninety percent of the samples were toxic to the organisms tested. The distribution of contamination is extremely patchy, with sample coverage too thin to delineate hot spot boundaries. Designation to the contaminated site list and clean-up of some areas of Salmon Bay are likely following further delineation of the boundaries of contamination. County combined sewer overflows (CSOs) may be implicated as contributing to some of these contaminated sites.

## **Puget Sound**

Puget Sound is a large estuary where fresh water draining from more than 10,000 streams and rivers mixes with salt water from the ocean. Water from the Pacific Ocean enters the sound through Admiralty Inlet and Deception Pass. Although Puget Sound is an estuary, it has near-oceanic salinity throughout most of the year. It is characterized by deep underwater valleys and ridges and has an average depth of 204 feet. Surrounded by 2,354 miles of shoreline, Puget Sound is a mosaic of beaches, bluffs, deltas, mudflats and wetlands. Much of the Puget Sound economy – tourism, fishing, maritime industry, timber harvest, etc. – is derived from its incredible environment. However, natural resource consumption and rapid growth and development are also placing increasing pressure on the Puget Sound environment.

### **General Conditions**

Nutrient and pathogen levels that may cause water quality problems in marine waters are typically seen in nearshore areas in the vicinity of contamination sources, such as stormwater or septic systems. While excess nutrients do not cause immediate harm to organisms living in the water column, excess nutrients can increase the amount of marine plants, which can deplete oxygen to levels incapable of sustaining aquatic organisms when it decays.

Dissolved oxygen (DO) concentrations in King County marine waters are routinely above the level at which potential problems could occur. Occasionally (generally once a year), some specific station(s) will exhibit low DO that may be due to the input of deep oceanic water, which contains naturally occurring low amounts of oxygen. These lower oxygen levels are not low enough, however, to kill marine organisms. DO levels as a whole at King County sites indicate good water quality.

As stated above, an excess of nutrients can cause water quality degradation. Nutrients in King County waters follow seasonal patterns and have been consistent for several years. Nutrient levels are lower than other areas in Puget Sound that are considered to have potential for nutrient-related water quality degradation. King County is currently conducting a detailed nutrient study to estimate the effects an increase of nutrients will have on water quality.

King County monitors fecal coliform and enterococcus bacteria in the water column. Results show that off-shore stations consistently meet Washington State Class AA marine surface water standards for fecal coliform bacteria and levels are low, if detected at all. Stormwater and fresh water runoff influence fecal coliform levels in water samples from intertidal beaches. As a result, some sites routinely exceed Class AA marine fecal coliform bacteria standards. These sites are located in bays or areas that have reduced mixing and retain fresh water inputs for a longer period of time, such as Tramp Harbor, Magnolia, and Fauntleroy Cove, or are near fresh water sources, such as Carkeek Park and Shilshole Bay. In summary, for the last five years off-shore stations consistently pass standards while stations near a fresh water source or in a bay regularly fail standards.

Sediment monitoring is a component of King County's monitoring programs, as many pollutants tend to be associated with particles that settle out onto bottom sediments. At sufficient concentrations, these compounds may be harmful to benthic organisms and may advance through the food chain, having a negative cumulative effect biologically. Pollutants in sediments at sites within King County (excluding the Duwamish River) generally meet Washington State Sediment Management Standards with the exception of areas located along the Seattle waterfront in inner Elliott Bay. This area routinely fails standards for mercury and certain compounds present in petroleum products and wood preservatives or are by-products of combustion. There are occasional standard failures at other locations, but the highest levels are found within Elliott Bay.

## Green River

The lower Green River, its valley and the Duwamish waterway are also urbanized, consisting of dense commercial and industrial development as well as some of the fastest growing suburban communities in King County. Much of the commercial and residential development in the valley depends on a levee and dike system. The middle Green River section includes rich farmlands and forestlands, as well as the cities of Black Diamond, Enumclaw, several state and county parks, and a salmonid fishery. The area is increasingly important as an affordable area for suburban and rural residences and hobby farms, is one of the largest remaining agricultural communities in King County, and provides extensive recreational opportunities for watershed and county residents. The upper Green River extends from the crest of the Cascade Mountains, the Green's headwaters, to the Tacoma diversion dam. It provides drinking water to the City of Tacoma and forest production for federal, state and private landowners.

### General Conditions

An assessment of the current water quality conditions in the Green-Duwamish watershed was compiled in 2000 from water quality reports and from analysis of water quality data collected during the past four years (1996-1999). Numerous streams throughout the watershed are listed on the state's 2000 list of water bodies that do not meet water quality standards. These streams are listed for failing to meet standards for one or more of the parameters used in measuring water quality.

Water quality in the Green River and its tributaries varies widely depending on location in the watershed, level of urbanization, and human activities. The upper Green River watershed is mostly forested, has been minimally altered by human activities, and thus generally has the best water quality. The middle Green River is dominated by agricultural land, mixed forest, and rural residential development, and still exhibits fairly good water quality conditions, but exceeds state temperature and nutrient standards along with possible metal and fecal coliform. The lower Green River and Duwamish River are the most urbanized and industrialized portions of the watershed and have the most degraded water quality conditions with impairments by metals and fecal coliform.

In the tributaries assessed, water quality is also closely linked to the level of urbanization and intensity of land use. Crisp Creek has the best overall water quality and is the least developed of the tributaries assessed. Newaukum Creek, which has extensive agricultural land use, generally has good water quality but suffers from occasional depressions in DO levels. Soos Creek has some of the region's best water quality of the smaller creeks in the urban portion of King County. Mill and Springbrook (Black River) creeks are the most heavily urbanized of the tributaries evaluated in this report and exhibit the most degraded water quality conditions.

Water quality conditions in the lower Green and Duwamish River have improved from the poor water quality conditions that existed in the 1960s and earlier. This is a result of the reduction of municipal and industrial discharges.

There has been a trend towards increasing water temperatures in most tributaries in the urban and urbanizing areas of the region over the past 20 years, probably attributable to urbanization and development, a concern for adult chinook migration up the Green River. DO levels are one of the most significant issues for salmonids in the basin. Certain amounts of DO are necessary for life processes of aquatic animals.

In general the water quality is good in the Duwamish estuary. The area of concern, however, is for the aquatic life that depends on sediment-dwelling organisms to thrive. Because of the poor conditions of some sediments in the Duwamish estuary, there may be risks to this aquatic life form; potentially translating to risks to salmonids via food-chain transfer, reduction in immune system functioning, or reduction in available food. This is an example of why sediment remediation is of high priority for the county.

## Sammamish River

“Long, straight and open” describe the Sammamish River. The river was straightened and dredged in the early 1960s for flood control and land use. Native vegetation was also removed from its banks, although recent recovery efforts are beginning to make a difference. Each year, thousands of people enjoy biking, hiking, horseback riding, in-line skating, and running along an adjacent trail extending from Bothell to Marymoor Park in Redmond. The Bear/Evans Creek system drains into the Sammamish River and was one of the major salmon producing streams in King County. The river has felt the impacts of development in the 70s and 80s that degraded fish habitat and increased flooding and erosion.

### General Conditions

The Sammamish River is on the Washington Department of Ecology's most recent list (1998) of water bodies that do not meet state water quality standards. The river has been found to exceed standards for water temperature, DO, pH and fecal coliform. (See Appendix A for glossary.)

High water temperatures in the summer and early fall, when chinook and sockeye salmon are returning to spawn in tributaries, are generally considered the most serious water quality problem limiting beneficial uses in the river. Water temperatures in the river can be harmful or lethal to salmon. The most serious water temperature problems in the river are located at its beginning, where it is fed by the warm upper layers of Lake Sammamish. The relationship between the lake and river means the Sammamish River probably has always been warmer than most northwest rivers in the summer and early fall, but the historic river channel provided much more cool-water refuge for salmon than the channel does today. The historic channel meandered through a vast wetland complex that dominated most of its corridor, providing much more shade, more pools and better connections with groundwater and tributaries, all of which cooled the river.

Another potentially significant water quality concern for the fresh waters within the Sammamish and Cedar River-Lake Washington watersheds is the presence of pesticides and herbicides in the water column and river sediments. Sampling for these chemicals has occurred in selected tributaries of these watersheds and additional sampling of the main rivers and lakes is taking place in 2001. These chemicals have been detected but the significance of the levels detected remains to be determined. Many of these chemicals do not have established water quality standards, or have standards that were established without regard to their potential non-lethal effects on salmon. Some of these chemicals may interfere with the ability of salmon to reproduce or to find their home streams for spawning. Through the SWAMP (see section on *Major Lakes Monitoring*) and related salmon recovery planning efforts, King County is studying the presence and effects of these chemicals in the river.

# Wastewater Treatment Facilities

The King County wastewater treatment system serves approximately 1.3 million residents in a 420-square-mile area. A total of 260 miles of pipe, 38 pump stations, and 22 regulator stations move wastewater from homes and businesses served by local agencies to two large regional treatment plants.

Wastewater coming into the plants undergoes a series of processes. Preliminary treatment removes items such as large sticks, rocks and rags. This is followed by primary treatment, a process that uses gravity to remove about 50 percent of the solids and associated pollutants from the wastewater. Secondary treatment is then provided. This is a highly aerated biological treatment process that consumes and removes an additional 40 percent of the solid materials. This highly treated water, or effluent, is then disinfected and pumped to a deep water diffuser, or “outfall,” into Puget Sound.

As a result of treating wastewater, the West Point Plant and South Plant produce biosolids, digester gas and reclaimed water. Biosolids are a highly treated, nutrient-rich solids product that is used in agriculture and forestry. Reclaimed water is secondary effluent treated to a higher degree for non-potable uses such as process water, irrigation and industrial heating and cooling. Reclaimed water is used both off-site and on-site at the treatment facilities. Digester gas is either sold or burned in engines to run pumps or generate electricity. The Vashon Treatment Plant produces treated effluent but transports its solids to the South Treatment Plant for processing into biosolids. It does not produce reclaimed water. In addition, King County operates two combined sewer overflow treatment facilities at Alki and Carkeek Park.

## Regulatory Compliance

The Clean Water Act states that all wastewater collection and treatment facilities that discharge effluent into surface waters are required to have a NPDES permit. King County currently operates three treatment plants, two CSO treatment facilities and associated CSO outfalls that discharge wastewater directly into Puget Sound, the Duwamish waterway, Elliott Bay, the Lake Union/Ship Canal and Lake Washington. The NPDES permits for these facilities are current and in compliance with the Washington Water Pollution Control Law and Federal Water Pollution Control Act (The Clean Water Act).

## **South Treatment Plant at Renton**

The South Treatment Plant treats wastewater flows from about 600,000 customers in the lower Green River basin, suburban cities east of Lake Washington and Seattle's Rainier Valley. The plant provides secondary treatment of wastewater and accepts and treats about 20 million gallons per year of septic tank solids from throughout the region as well as sludge from neighboring treatment facilities such as Snoqualmie Valley cities and the Vashon Treatment Plant. The plant produces biosolids for land application, effluent suitable for reuse, and methane for sale to a local utility.

The South Treatment Plant has a monthly wet-weather average capacity of 115 million gallons per day (mgd). The pumping capacity at the South Treatment Plant was recently upgraded to handle a maximum peak flow of 325 mgd. The outfall in Puget Sound discharges secondary effluent 10,000 feet from shore at a depth of 625 feet into the denser lower water layer, and moves southward in the Sound. The effluent plume remains at or below a depth of 425 feet in the vicinity of the outfall.

Despite the fluctuation of flow and influent composition, the plant's secondary treatment process produces high quality effluent consistently. The treatment process is affected by influent strength (raw sewage, stormwater and ground water), influent quality, temperature and varying weather conditions. At the South Treatment Plant, the average flow in 2000 was 80.2 mgd with a maximum average flow per month of 103.9 mgd. Treatment efficiency in 2000 remained high and consistent.

## **West Point Treatment Plant**

The West Point Treatment Plant treats wastewater flows from about 700,000 customers located in the greater Seattle area and in southwest Snohomish County. It is a secondary treatment plant and is currently the largest plant in the King County system. Located on the shore of Puget Sound next to Discovery Park, it has an average wet-weather, non-storm capacity of 133 mgd and a peak wet-weather capacity of 440 mgd. After treatment, the secondary effluent is discharged through an outfall to Puget Sound. The outfall discharges 3,600 feet from shore at a depth of 240 feet into the upper water layer. The effluent plume remains at or below a depth of 88 feet near the outfall and flows northward out of Puget Sound most of the year.

The wastewater treatment system at the West Point Treatment Plant consists of multi-stage processes similar to those described for the South Treatment Plant. However, a high purity oxygen process rather than a conventional secondary process was constructed at the West Point Treatment Plant. Similar to the South Treatment Plant, the West Point Treatment Plant produces biosolids for land application, effluent suitable for reuse, and methane for plant operation. In addition, the West Point Treatment Plant uses methane for cogeneration of electricity, and the generated electricity is then sold to Seattle City Light.

The peak capacity of the plant is 440 mgd. However, the NPDES permit requires that the plant provide secondary treatment to flows up to 300 mgd. Flows greater than 300 mgd are considered to be CSOs (see section on *Combined Sewer Overflows*) and the plant is required to provide these flows with primary treatment, disinfection and dechlorination.

As noted in the discussion of the South Treatment Plant, despite the fluctuation in volume of flow and the composition of the influent, the treatment process at the plant produces a consistently high quality effluent. At the West Point Treatment Plant, the average flow in 2000 was 110.6 mgd with a maximum monthly average of 141.1 mgd.

## **Vashon Wastewater Treatment Plant**

The Vashon Treatment Plant is located just northeast of the unincorporated Town of Vashon. This secondary treatment plant was constructed in 1975 and operated by the Vashon Sewer District until 1999 when King County assumed responsibility for the plant. The plant was designed with a maximum monthly average capacity of 0.264 mgd and a peak wet-weather capacity of approximately 1.0 mgd. After secondary treatment and disinfection, the effluent is discharged through an outfall to Puget Sound. The outfall discharges 1,300 feet offshore of the eastern shoreline of the island at a depth of 41 feet. At the Vashon facility, the average flow in 2000 was 0.089 mgd with a maximum monthly average of .131 mgd. While these flows seem to be fairly low, the total amount of solid materials that the plant is processing is almost at the level of the plant's design capacity. A new construction project for additional secondary treatment facilities is expected to be complete by 2005.

The treatment plant's history has been marked by numerous NPDES permit violations. However, since King County has taken over operations, and facilities have been enhanced, there have been very few permit incidences since November 1999. In 2000, the Vashon facility had only five permit exceptions, with three of those being technical in nature. In 2000, 18 off-shore sediment stations located around the Vashon outfall site were sampled to obtain baseline sediment quality information. Sediments were analyzed for organic compounds and metals, among others. Of the samples tested, none exceeded regulatory standards.

## **Alki and Carkeek CSO Treatment Plants**

The Alki and Carkeek CSO (see below section on *Combined Sewer Overflows*) treatment plants provide primary treatment of excess flows that occur in the combined sewer system during storm events.

The Carkeek plant and pumping station was originally constructed to provide primary treatment to all flows reaching the plant. In 1994 new pipelines were completed to transfer flows less than 8.4 mgd to the West Point Treatment Plant for secondary treatment and discharge. However, when flows exceed 8.4 mgd, the Carkeek plant provides CSO treatment equivalent to primary treatment, as well as disinfection, of the excess flows prior to discharging the flows to Puget Sound. The Carkeek outfall discharges 2,100 feet offshore at a depth of about 200 feet; the effluent plume normally remains at or below a depth of 100 feet. The transfer of flows from Carkeek to the West Point Treatment Plant since 1994 has reduced the amount of primary effluent discharged from the Carkeek Treatment Plant from approximately 1,351 million gallons per year. The plant operated 20 times in the reporting year of 1999/2000, discharging a total of six times. There was eight million gallons of discharge released and the effluent met the annual permit limits. The discharge volume was down compared to previous years, when higher volumes placed the plant in violation of its five-year average flow permit limit. A project is underway to deal with the excess flows.

The Alki Treatment Plant was originally constructed to provide primary treatment to all flows reaching the plant. A conveyance system, the West Seattle Tunnel, was constructed in 1998 to transfer sewage and stormwater flows up to 18.9 mgd from Alki via the Elliott Bay Interceptor to the West Point Treatment Plant for secondary treatment. Flows in excess of 18.9 mgd are provided CSO treatment equivalent to primary treatment at Alki, disinfected and discharged to Puget Sound. The Alki outfall discharges 1,900 feet offshore at a depth of 143 feet. The transfer of flows from Alki to the West Point Treatment Plant since 1998 has reduced the amount of primary effluent discharged from the Alki Treatment Plant from approximately 2,500 million gallons per year. In the 1999/2000 reporting period, two discharge events occurred and 3.92 million gallons were discharged. The Alki Treatment Plant performed within permit limitations.

## Combined Sewer Overflows

CSOs are discharges of untreated sewage and stormwater released directly into marine waters, lakes and rivers during periods of heavy rainfall. CSOs come from combined sewer systems that were designed to carry both sanitary sewage and stormwater drainage. The City of Seattle is the only sewerage agency served by King County that has a combined sewer system. A separated sewer system, now the standard, is designed to carry untreated sewage to a treatment plant while directing storm drainage to the nearest water body.

King County's conveyance system is designed to carry combined sewage and stormwater runoff in about 55 percent of the West Point service area. When flow volumes remain within the capacity of the sewage system they are pumped or transported via gravity through the interceptors to the West Point Treatment Plant for secondary treatment prior to discharge. However, the sewage system is not designed to transport and/or store all of the water that enters the system during large storms. To handle storm capacity, pressure relief points, called CSOs, are provided to allow the excess flows to discharge into local water bodies, rather than damaging conveyance facilities or backing up into homes and streets. Approximately 90 percent of the CSO volume is stormwater, and only ten percent is wastewater.

CSO sites that meet the Washington State standard of an average of no more than one untreated discharge per year per outfall are referred to as "controlled." Those that do not meet the standards are referred to as "uncontrolled." While uncontrolled CSOs can occur year-round, most occur from September through March, while any single event per year from controlled CSOs will usually occur from December through February during large storm events.

King County's aggressive CSO control program, as outlined in the RWSP, is a continuation of a CSO control program that has been going on for many years. At present, the total volume of King County's untreated CSO discharges is equal to only about two percent of the total volume of all wastewater discharges in the system. Of this, about 1.3 percent is discharged to marine waters, and about 0.7 percent is discharged to fresh water in the Duwamish River, Lake Washington or the Ship Canal.

The total number of CSO events in 1999/2000 was 198, with total system volumes of 587 million gallons (MG). Of this, 39 MG overflowed in the northern service area and 548 MG in the southern service area. These numbers are significantly lower than baseline studies done in 1981-83 and can be attributed to CSO control progress, recent CSO project completion, as well as below average rainfall and storm events. More information about specific CSOs can be found in the *1999/00 Combined Sewer Overflow Report*.

**Table 1**  
**1999/2000 Combined Sewer Overflows**

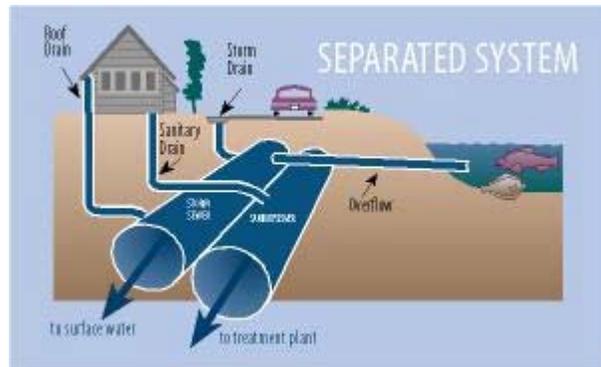
<b>Location</b>	<b>Total CSO Events</b>	<b>Total Volume (Million Gallons)</b>
Pump and Regulator Stations	198	587.3
Alki CSO Treatment Plant	2	4
Carkeek CSO Treatment Plant	6	8

\*Reporting period is June 1999 through May 2000.

Two large CSO control projects are currently underway. The Denny Way CSO Control Project will control discharges into Lake Union and Elliott Bay using the Denny Way Regulator Station, reducing untreated discharges from approximately 50 per year to one per year. The other project is the Henderson/Martin Luther King Jr. Way/Norfolk CSO Control Project. This project will build a 3.2 MG storage/treatment tunnel to control excess overflows and achieve the desired outcome of one untreated event per year.



**Fig. 1 – Illustration of an older combined system (pre-1950's) in which sanitary sewage is conveyed in one pipe and stormwater sewage conveyed in another.**



**Fig. 2 – Illustration of a typical separated sewer system.**



**Fig. 3 – Illustration of a typical modern combined sewer system (post-1950's).**

## Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) are discharges of raw wastewater (as opposed to diluted wastewater from combined sewers) from municipal sanitary sewer systems. SSOs can release untreated sewage, before it can reach a treatment facility, into basements, out of manholes and onto city streets or into streams.

Overflows from the separate sanitary conveyance system occur occasionally, typically during extreme storm events and power outages. Minimizing the discharge of untreated wastewater is paramount to the mission of the Wastewater Treatment Division. Extensive resources are committed to maintaining the integrity of the system and preventing SSOs.

There were eight SSOs reported by King County in 2000, which is below the annual average of 16 (based on averages over a 14 year period). Four overflowed into Puget Sound, two into Lake Washington and one each into the Sammamish River and the Green River. They ranged in magnitude from small leaks in sewer lines to larger releases from treatment plants and pump stations.

In all cases, the county's overflow response procedures were implemented. These procedures include posting the area, sampling and public notification as appropriate for the nature of the overflow. While there is some short-term risk to public health and the environment from SSOs, there are no long-term effects from this volume of release.

**Table 2**  
**2000 Sanitary Sewer Overflows**

<b>Date</b>	<b>Location</b>	<b>Est. Volume (MG)</b>	<b>Hours</b>	<b>Reason for Overflow</b>
Jan. 4	West Point TP	18	1.5	High flows and equip. malfunction
Feb. 1*	Vashon TP	0.035	21	Heavy rainfall
May 4	Yarrow Bay PS	0.067	2.25	Equipment malfunction
Aug. 31	Kenmore PS	0.083	0.12	Equipment malfunction
Sept. 16	Hidden Lake PS	0.008	0.42	Equipment failure due to power surge
Oct. 2	Hidden Lake PS	0.066	2	Equipment failure due to power surge
Oct. 18*	South TP	8	1.5	Equipment malfunction
Dec. 12	Wilburton Siphon	**	48	Leak in old pipe

\*Not a complete bypass of the treatment process; wastewater flows received some level of treatment.

\*\*A leak of < 0.5 liters per minute.

# Water Monitoring Programs

Ensuring the health of county water bodies, as well as the health of the people using them, is the purpose of King County's extensive water monitoring programs. King County is continuously assessing the quality of the effluent at each of its wastewater treatment facilities, the receiving water around each outfall, and nearby beaches to ensure the facility is meeting the goals of the Clean Water Act and other regulatory requirements. Equipped with an environmental laboratory, an expert staff of scientists and outstanding volunteer programs, the county monitors the quality of all of its water bodies as well as the life within them, known as "environmental indicators," such as amphibians, stream bugs and fish.

## Major Lakes Monitoring

The Major Lakes Monitoring Program is designed to protect the significant investment in water quality improvements and protection made by the people of King County. Though most sewage is now sent to treatment plants, monitoring water quality is still important. Sampling and flow monitoring sites are distributed around the lakes and streams to monitor the long-term environmental quality of these waters.

Samples are collected every two weeks, except during the winter months, from five sites in Lake Union, 13 sites in Lake Washington, and seven sites in Lake Sammamish. Each of the lakes has one or more sampling stations located in its deep central basin where the influence of the shoreline is muted by the mixing action of wind and waves. Changes observed over time at these sites reflect broad, large scale or landscape scale changes in the watershed and the lake. Other sampling stations are distributed around the shoreline of the lake, primarily off the mouths of influent streams. Changes in water quality at these stations are more directly influenced by shoreline activities and by the quality and quantity of inflowing stream water. Each site is sampled for temperature, DO, pH, conductivity, clarity, phosphorus, nitrogen and fecal coliform bacteria (see Appendix A for glossary).

## The Sammamish Washington Analysis and Modeling Project (SWAMP)

The SWAMP is a coordinated water quantity and quality monitoring and modeling project that will support water resource decisions in the fresh waters of King County. A major component of this project is to configure a computer model for lakes Washington, Sammamish and Union. Coupled with this model will be a watershed model that simulates stream flow and water quality resulting from historic, current and future land use within King County watersheds. A coordinated water quality assessment will evaluate potential risks to human health, wildlife and aquatic life, including threatened and endangered species (e.g. chinook salmon, bull trout), using the physical, chemical, biological, pathogen, and water and sediment quality data from the monitoring program and the modeling efforts. Potential risks and water quality conditions will be assessed for both current and future conditions. The SWAMP is directly linked and coordinated with current King County water resource monitoring efforts.

## **Remote Underwater Sampling Station™**

King County installed five robotic buoys to collect water quality data from Lake Washington and Lake Sammamish in July 2000. The buoys collect water samples automatically, 24 hours a day, 365 days a year, with occasional maintenance. Data are transmitted daily to a King County computer and is available online at <http://www.metrokc.gov/lakedata>. The data from the buoys will contribute to the development of the models of Lake Washington, Lake Sammamish, the Sammamish River and the Lake Washington Ship Canal. In addition to buoy data, the models will include input from rivers/streams, non-point surface run-off, groundwater and precipitation.

## **Beach and Stream Monitoring**

### **Swimming Beach Monitoring**

During the summers of 1996- 2000, swimming beaches on lakes Sammamish, Washington, and Green Lake were surveyed to determine levels of bacterial pollution and relative human health risks. Prior to this survey little local data on bacterial levels at these swimming beaches existed. Substantial amounts of bacterial data are collected in lakes Sammamish and Washington from the King County lake assessment long-term monitoring program, but these data are not collected within designated swimming beaches or boat anchorages.

Fecal coliform bacteria are routinely sampled as an indicator of waste pollution in water and as an indicator of the human health risk from swimming in contaminated waters. Elevated counts of fecal coliform bacteria always occur when sewage is present in the waters. However, high bacteria counts do not necessarily indicate human sewage pollution because many other mammals and birds can also contribute this type of bacteria to the water. To identify whether the bacteria are from human sewage, tests for the presence of specific bacteria have been used. Closed beaches are well marked with signs alerting people to the closures. There were fewer beach closures in 2000 than in years past, with only two swimming beach closures (Juanita Beach and Madison Park), which were not the result of an overflow event.

### **Stream Monitoring**

Streams and rivers in the King County service area are monitored as part of the routine monitoring program if they cross sewer trunk lines or if they are considered a potential or significant source of pollutant loading to a major water body. Monthly baseflow samples have been collected along some of the tributaries flowing into Lake Washington and Lake Sammamish since 1979.

Sixty-three sites on three rivers and 27 streams have been sampled monthly under baseflow conditions – some for more than 20 years. For this report, the 1996 through 2000 data were used to evaluate the water quality conditions at those sites. Generally, conditions seem to be at least good and at some sites, extraordinarily good compared to the Ecology Water Quality Criteria. Water quality seems to degrade with increasing population density. In most streams and rivers, water quality seems to be better in the upper reaches where development is minimal.

## **Small Streams Toxicity/Pesticide Study**

The Small Streams Toxicity/Pesticide Study is an assessment of toxicity in urban streams under both storm and base-flow conditions. It is also an effort to collect and evaluate information on potential toxins, primarily pesticides and metals. This effort, in 2001, will be the third year of a multi-year study and is part of King County's SWAMP.

The study was begun in 1999 when King County collaborated with the United States Geological Survey and state Department of Ecology to collect and test water samples from Lyon, Juanita, Lewis and Rock creeks. Results indicated that several pesticides and metals were present, and toxicity was observed in all study streams during different times of the year, except Rock Creek, which served as the study reference site.

To better understand the environmental significance of this toxicity information, sampling in 2000 was conducted in streams where additional habitat and water quality data has been collected: Swamp and Little Bear creeks. Habitat assessments, fisheries use assessments, and benthic taxonomy (classification of aquatic life) analysis have been completed for both of these creeks. This information, along with the toxicity, pesticides and metals data that were collected in 2000, will be used as part of the SWAMP risk assessment to evaluate the environmental significance of the toxicity information. Preliminary results from 2000 again showed that several pesticides and metals were present and toxicity was observed in the test streams.

Efforts in 2000 were also begun to develop a test method to determine the general class of contaminant likely causing the observed toxicity. Preliminary results of these new test methods suggested that different causative agents are likely responsible for the observed toxicity. On occasion, dissolved metals appear to be causing the observed toxicity, while at other times organic compounds appear to be the cause.

Information gathered during this study will be used to determine whether finding a specific causal agent of toxicity is possible, to understand and focus future investigative efforts, to understand the environmental significance of observed toxicity, to begin to determine whether best management practices will be useful in preventing toxicity, and to begin to understand treatment objectives for the use of reclaimed water within the watershed.

## **Marine Monitoring**

King County is responsible for monitoring the water and sediment quality of Puget Sound within county borders in order to protect and preserve the unique, productive and diverse marine environment. King County's marine monitoring programs are constructed to assess potential effects to water quality from both point and nonpoint sources of pollution and focus on marine waters and their underlying sediments. Point source pollution is characterized by its entry into the aquatic environment from a specific facility, such as an outfall pipe. It can be generated from a variety of industrial and municipal facilities including sewage treatment plants and manufacturing facilities. Nonpoint source pollution comes from any source that is not a point source, including runoff from agricultural and urban areas.

King County collects water, sediment, shellfish tissues and algae for the point source monitoring program. Point source stations include those that are required by the county's NPDES permit (such as around the West Point Treatment Plant outfall) and those that are in close proximity to treatment plant discharges (such as beach stations near the West Point Treatment Plant). Waters are analyzed for bacteria, temperature, water clarity, salinity, DO, nutrients and chlorophyll. Sediments are analyzed for pollutants (metals and organic compounds), physical parameters (grain size and total solids), and organic carbon, total sulfides and volatile solids. Analysis of organisms living in the sediment is also conducted at a few selected sites. Shellfish tissues are analyzed for bacteria and pollutants (metals and organic compounds) and algae are analyzed for metals.

The county collects water, sediment, shellfish tissues and algae for the ambient monitoring program. Ambient stations provide background information to compare data obtained from the point source monitoring program and are located in areas outside the immediate influence of known discharges. Parameters measured are the same as those measured for the point source program.

Results from both monitoring programs are provided and discussed in an annual report entitled *Water Quality Status Report for Marine Waters*.

### **Marine Outfall Siting Study (MOSS)**

The MOSS is an expansive study of the oceanography, chemistry and biology of the marine waters of the north central Puget Sound basin. This study was undertaken as part of the Brightwater treatment facilities project to help locate optimal sites for construction and operation of the marine outfall for the new wastewater treatment plant. This multi-year study has collected hundreds of water samples for analysis of organic chemicals such as solvents and pesticides, metals, nutrients and bacteria. A multi-year study is also underway to look at primary production in this area of Puget Sound and the effect of nutrient addition to marine plant life (phytoplankton) growth. A complete habitat assessment of the marine environment in the area has been completed as a joint effort between King County and Battelle Marine Sciences Laboratory. The oceanography of the region is being studied to look at the physics of water movement. State-of-the art science and technology has been employed in these efforts, such as deep, acoustic Doppler current meters and automated underwater vehicles or, literally, small remote sensing submarines that measure such things as salinity and temperature.

# Water Quality Management Programs

## Hazardous Waste Management Program

King County is an active participant in a regional program that addresses hazardous wastes from small businesses and households called the Local Hazardous Waste Management Program. This regional program is a consortium of King County (Water and Land Resources and Solid Waste divisions), City of Seattle Public Utilities, Public Health - Seattle and King County, and the Suburban Cities Association. The program provides technical assistance, reimbursement and recognition to "small quantity generator" businesses to help them reduce and properly manage hazardous wastes. It also provides collection services for household hazardous wastes as well as public education aimed at proper handling and reduction in use of hazardous household products.

The Local Hazardous Waste Management Program works closely with and complementary to King County's Industrial Waste Program. Both address source control of pollutants and other problem chemicals that enter the county's wastewater treatment system and local waters. Generally speaking, the Industrial Waste Program focuses on larger businesses in a regulatory manner, issuing permits and discharge authorizations under a federally-mandated pretreatment program. The Hazardous Waste Management Program focuses on smaller businesses as well as households in a non-regulatory approach, providing technical assistance, resources and education under a state-mandated program. The two complementary approaches work well together, enhancing the county's ability to address pollutants from a wide variety of sources.

In the year 2000, the Hazardous Waste Management Program provided on-site technical assistance to more than 3,000 local businesses. The program helped local businesses stop discharging 10,000 gallons of hazardous chemical-bearing wastewaters, including silver-contaminated wastes from photoprocessors, mercury-contaminated wastes from dental offices, solvents, oils and corrosive chemicals.

In schools, more than 8,000 school children were taught about hazardous chemical safety, reduction in use, safer alternatives and connections to family health and environmental protection. The science labs of 114 local middle and high schools were assisted in safely disposing of 12,000 containers (934 drums) of hazardous chemicals, including many highly explosive or extremely toxic substances.

More than 1,600 tons of household hazardous waste was collected for safe handling, thus preventing these chemical wastes from going down the drain or into the garbage. In addition more than 100,000 King County residents were contacted through a variety of education services with messages about hazardous waste reduction, safer alternatives, etc.

In addition, the Hazardous Waste Management Program kept hazardous chemicals directly out of local waters by reducing use of lawn and garden pesticides, keeping wastes out of storm drains, and collecting many tons of wastes that might otherwise have been improperly disposed of.

The Hazardous Waste Management Program helped develop an Integrated Pest Management (IPM) Program for use throughout King County's departments and operations. Through IPM, there was a 51 percent reduction in total pesticide use by the county, 2,800 pounds of old pesticides was properly disposed of, and many other innovative alternative pest management approaches were incorporated.

These activities helped to reduce air emissions within the sewerage (collection) system and treatment plants caused by solvents and other hazardous air pollutants. Potentially problematic chemicals that could affect the secondary biological treatment processes have been reduced. By reducing hazardous waste, heavy metals and organics that accumulate in the solids are reduced, making biosolid products more useable and more acceptable to customers and the public. The program ultimately reduces the discharge of heavy metals and organic chemicals in plant effluents into Puget Sound.

## **Industrial Waste**

The Industrial Waste Program regulates industrial wastewater discharged into the King County sewerage system. The core work of the Industrial Waste Program includes issuing discharge approvals to companies, then following up with monitoring, inspections and enforcement. The purpose is to see that industries treat wastewater before discharging it to control harmful substances such as metals, oils, acids, flammables, organic compounds, gases or solids. This program protects surface water quality, the environment, public health, the sewerage system, its workers and the quality of biosolids.

The Industrial Waste Program may regulate any industry, from largest to smallest, if it discharges wastewater to the sewer. To do this, the Industrial Waste Program issues two main kinds of discharge approvals: permits and discharge authorizations. Permits are issued to significant industrial users. These industries discharge more than 25,000 gallons per day and/or are in federal categories. The U.S. Environmental Protection Agency requires at least 20 categories of industries to get permits, whatever their size or quantity of wastewater. Permits have more comprehensive requirements than discharge authorizations and require a company to self-monitor its discharge. During 2000, the Industrial Waste Program had 149 permits and 294 discharge authorizations in effect.

Industrial waste investigators inspect facilities before issuing discharge approvals and also inspect those with approvals to see that they are complying with regulations. In 2000, investigators made 380 inspections. Industrial waste specialists take samples at facilities to see whether wastewater complies with regulations. In 2000 our specialists collected 2,683 compliance samples and found 274 discharge violations. The Industrial Waste Program also requires most companies to self-monitor their discharges. Data for 2000 are not available at this writing but are expected to be similar to 1999 when companies reported that they had made 23,185 analyses of self-monitored samples. After violations are found, inspections and sampling check that violating conditions have been eliminated.

The Industrial Waste 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, the Industrial Waste Program uses tools such as compliance schedules, fines, charges for monitoring and inspections, and cost recovery for damages.

## Sediment Management Program

King County developed a draft Sediment Management Plan (SMP) as directed in the RWSP. The plan identified and evaluated programmatic long-range remediation alternatives for consideration at seven identified sediment clean-up sites near King County CSO outfalls. These seven sites represent the identified contaminated sediment sites in Puget Sound for which the county has responsibility. These sites are near the following King County CSO outfall sites: Hanford Street, Lander Street, Duwamish Pump Station, Brandon Street, King Street, Denny Way and Chelan Avenue.

The state Department of Ecology is granted legal authority under Washington Administrative Code (WAC) 173-204, Sediment Management Standards, to direct the identification, screening, ranking and prioritization, and clean-up of contaminated sediment sites in the state. Once a site is ranked and placed on the contaminated sites list, it may then be considered for clean-up. WAC 173-204 provides for the voluntary clean-up of contaminated sediments with oversight and guidance by the Department of Ecology. Alternatively, the Department of Ecology or the U.S. Environmental Protection Agency may initiate enforcement actions (including cost recovery) at some time in the future, under the Washington Model Toxics Control Act (MTCA) or the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund. The county is moving ahead with the clean-up of these seven identified sites using the voluntary approach whenever possible and participating in state or federal clean-up processes where they have begun.

In the year 2000, the Sediment Management Program:

- Entered into a memorandum of agreement with the City of Seattle, the Port of Seattle and The Boeing Company to undertake the first steps in the clean-up of the Duwamish Waterway – sharing costs of developing the Remedial Investigation and Feasibility Study (RI/FS): the first steps of a clean-up plan for the waterway
- Signed an Administrative Order of Consent with the other members and the U.S. Environmental Protection Agency and state Department of Ecology to conduct the RI/FS under the CERCLA and MTCA.
- Developed a scope of work and request for proposals to develop a model, identified in the SMP. The model is needed to accurately predict any potential for recontamination of clean-up sites from ongoing CSO discharges, the viability of natural recovery as a clean-up alternative and the need for a designated sediment impact zone. The modeling is necessary to gain state approval of proposed clean-up actions.
- Entered into a memorandum of agreement with the state Department of Natural Resources (WADNR) to develop a decision process for clean-up decisions on state-owned aquatic lands and a general plan of operations for clean-up site leases. The process and plan of operations would then be applied to specific county sites needing WADNR lease agreements for clean-up actions.
- Renewed a WADNR lease for the experimental Denny Way sediment cap to continue monitoring effectiveness as a viable clean-up option

- Selected the preferred alternative for the Elliot Bay/Duwamish Restoration Panel clean-up of the Duwamish/Diagonal CSO. This project now moves into the site design phase.
- Started negotiations with Port of Seattle on the county share of costs for contaminated dredged material disposal costs in the East Waterway Harbor Improvement Project. A cooperative project may be pursued to address two county CSOs that discharge into the East Waterway near contaminated sediment sites on the state list.

## Biosolids

Biosolids are the nutrient-rich organic byproducts of the wastewater treatment process. Biosolids are recycled as a soil amendment because they contain essential nutrients needed for plant growth and development. Their high organic matter content also aids in reducing erosion by improving soil structure, moisture holding capacity and tilth.

The King County Biosolids Management Program recycles more than 130,000 wet tons annually in forestry, agriculture, soil reclamation and compost applications. The U.S. Environmental Protection Agency and state Department of Ecology regulate biosolids quality and land application practices. Routine monitoring is done to ensure the safety of recycled biosolids. The 2000 data for biosolids generated by the West Point Treatment Plant and the South Treatment Plant show that King County biosolids quality is excellent when compared to all relevant criteria. Concentrations of regulated metals in biosolids were consistently below the most stringent federal standards, meaning they are safe for all land application projects.

King County has conducted research and monitored the quality of streams near forest application sites since 1986. Water quality monitoring results from 2000 continue to show little effects from biosolids. As part of the ESA 4(d) rule review, the county provided documentation to the National Marine Fisheries Service (NMFS) on the biosolids forestry program, including results of water quality monitoring and beneficial effects on soils and vegetation. In 2000, the NMFS concluded that the program poses no risk to chinook salmon, and in fact, results in an environmental benefit.

## Septic Conversions

The King County Comprehensive Plan establishes a goal of having the entire Urban Growth Area (UGA) sewer by the year 2020. The King County Wastewater Treatment Division uses this goal as a planning assumption for determining future wastewater capacity for its wastewater service area. Accordingly, by 2020, King County's wastewater system will have sufficient capacity to accommodate the entire population within the wastewater service area. In practice, achieving the Comprehensive Plan goal will be a difficult, complex, and expensive undertaking, requiring local sewer providers to extend their service to currently unsewered areas within the regional wastewater service area. It will also require local sewer providers to develop or update their policies to provide residents assistance in acquiring sanitary sewer service or require them to connect under circumstances less severe than outright system failure.

Public Health - Seattle & King County is now coordinating with the King County Department of Natural Resources to develop a database of property owners who are currently on septic tanks. These owners will receive information about maintaining their systems per Title 13 of the King County Board of Health.

At the present time, property owners with septic systems are not required to connect to the sanitary system even if it is available on their street. However, they are required to hook up to the sanitary system if it is available and 1) their septic system fails, or 2) if their septic system needs to be enlarged to accommodate a home remodel.

## Upcoming Issues

In the coming year, King County will face some unique challenges as well as be presented with some new opportunities for change. Creating a balance in water needs and water resources for fish and people will be an ongoing focus for the county. The implementation of a new water reuse demonstration project will provide a benchmark in the county's conservation efforts. Similarly, the listing of chinook salmon under the ESA will impact every aspect of our already water quality-focused, wastewater treatment processes and monitoring.

## Water Reuse Projects

After the RWSP was adopted in 1999, the King County Department of Natural Resources began researching potential reclaimed water projects. The goal of the county's reclaimed water program is to "use reclaimed water to assist the region to balance water resource needs of the environment and people."

In 2000, King County requested written project nominations from public and private parties interested in partnering on water reuse projects. The county received 12 nominations for water reuse demonstration projects in Bellevue, Newcastle, Issaquah, Covington, North Creek, Tukwila, the University of Washington, and near the Sammamish River. Of the nominations, a demonstration project for the Sammamish River was recommended based on review of the criteria. The demonstration facility will combine pilot-scale technologies into a small-scale process to assess their ability to meet project objectives. Construction of the facility and related utilities will be completed in April 2001 and the facility is expected to be operating in May 2001 for a nine-month period at the West Point Treatment Plant.

The listing of chinook salmon under the ESA may encourage uses of reclaimed water since its use is known to improve or enhance stream flow. For some water users, the imposition of limits on existing and future water resources and imposition of higher effluent standards on discharges as a result of the ESA listing, may encourage the transition from current water supplies to reclaimed water.

## ESA Activities

In 2000, King County worked with the NMFS to develop a "limitation" on take, to be included in the 4(d) rule for chinook salmon. A limitation means that if activities are conducted according to their description in the 4(d) rule, they are not considered a "take". For example, discharges from King County's secondary treatment plants, if done according to stipulations in the 4(d) rule, would not be considered a take of protected species. King County's proposal is to include discharges within NPDES permit limits and CSOs controlled to an average of no more than one untreated event per year in the limitation. We expect to complete discussions with NMFS in the first half of 2001.

The chinook 4(d) rule, which became effective January 8, 2001, addresses many activities conducted by the county's Wastewater Treatment Division, e.g. development within 200 feet of water bodies, construction of sewer lines in streets, and control of stormwater from facility sites. In 2000 the county began a review of its activities to determine how the Wastewater Treatment Division should modify its practices to stay within the parameters set out in the 4(d) rule. The intent is to meet the spirit of the ESA even in cases where there is no permitting agency to enforce the ESA.

The Habitat Conservation Plan continued development in 2000. The county developed a work plan, reviewed by the regulatory agencies, tribal governments and major stakeholders, such as environmental groups. A stakeholder involvement plan was developed and underwent a process to determine if there were instances where water quality standards, as enforced by the state Department of Ecology, are not sufficient to protect listed species from wastewater discharges. This "water quality effects" work continues into 2001.

In 2000, the King County Department of Natural Resources prepared biological assessments under Section 7 of the ESA for two capital projects that have a federal nexus: the Madsen Creek Pipeline Protection and Stream Restoration Project and the Swamp Creek Trunk Extension Project. King County Department of Natural Resources will prepare biological assessments for at least two capital projects in 2001. The Section 7 process has facilitated the development of better projects that incorporate protective measures for aquatic species and their habitat.

## **Watershed Resource Inventory Area Planning**

In collaboration with the Sammamish Watershed Forum (an organization of all the local governments in the Sammamish watershed), King County and the U.S. Army Corps of Engineers are developing an action plan in 2001 for the conservation of natural resources in the Sammamish River corridor. The plan will focus on actions that can support the recovery of salmon in the greater Lake Washington watershed, so it is expected to develop recommendations to address temperature and other water quality problems in the river. Because most of the Sammamish River's tributaries are substantially cooler than the river, restoration projects may target enhancements to their confluences with the river, with the goal of creating greater cool-water refuge for adult salmon migrating through the river.

## **Anti-Degradation Regulations**

The state Department of Ecology is expected to propose revisions to their surface water quality standards and procedures. They will be considering modifying their permit renewal processes to include more strict evaluations of whether projects lower water quality in water bodies throughout the state and protect clean water.

The new anti-degradation criteria procedure could potentially block new discharges into water bodies with especially high quality or those already impaired by a parameter (for example temperature or DO) a new discharge might further impair. King County's future wastewater projects will be subject to this new procedure if implemented by the state Department of Ecology.

## **Total Maximum Daily Loads**

According to the U.S. Environmental Protection Agency, a total maximum daily load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. When a water body fails to meet quality standards the Clean Water Act requires that a TMDL and a pollutant allocation be done for that water body. The U.S. Environmental Protection Agency or the state Department of Ecology makes allocations of that pollutant to its sources, such as storm runoff or industrial discharges.

Any water bodies consistently identified by the state as not meeting water quality standards must have a TMDL prepared and implemented in the next ten years. New federal rules for performing TMDL analysis will go into effect in October 2001. These new rules and the great number of King County water bodies listed by the state will require additional attention to water quality data collection and modeling so that TMDL calculations done by the state Department of Ecology are as accurate and complete as possible.

In 2000 King County completed its second year of a joint project with the state Department of Ecology to begin work on TMDLs for certain county water bodies. In particular, a model sediment TMDL has been developed and is in the approval process.

## **Endocrine Disrupters**

Chemicals that mimic hormones in animals (fish, birds, people) may sometimes result in changes in how an animal's endocrine system works. These chemicals have been termed "endocrine disrupters." Some of these chemicals may be found in treated municipal wastewater.

As a part of the environmental investigations related to the Brightwater facility siting studies, King County has assembled a document to provide a review of the scientific literature on potentially endocrine disrupting substances potentially present in treated municipal wastewater. Titled, "Endocrine Disrupters in Secondary Treated Effluent: Toxicological Effects in Aquatic Species," it discusses endocrine disrupting chemicals, their toxicological effects on aquatic species, and the current state of endocrine disrupter research.

## **Sediments**

The U.S. Environmental Protection Agency is considering expanding the Superfund site designation along the east shoreline of Harbor Island to cover the entire East Waterway. This would mean the dredging scheduled to be done under the East Waterway Harbor Improvement Project (see Sediment Management Program discussion under Water Quality Management Programs) would become a CERCLA clean-up action through the Superfund. The county would become involved because of CSO discharges at the site. This could result in changes in the CSO control projects' priority and schedule to address source control issues and changes in the schedule to coordinate clean-up actions.

# Appendix A - Glossary

**Algae:** Plants that grow in surface waters in relative proportion to the amount of light, nutrients and attachment sites available. Algae are food for fish and other aquatic organisms.

**Benthos:** The communities of aquatic life that dwell in or on the bottom of sediments of a water body.

**Biochemical Oxygen Demand (BOD):** Refers to the amount of dissolved oxygen required to meet the metabolic needs of microorganisms in water, wastewater and effluents.

**Biosolids:** The organic solids separated from raw wastewater or produced by the wastewater treatment process. Biosolids contain large amounts of organic matter.

**Chlorophyll:** The green pigment in plants that allows them to create energy from light (photosynthesis). By measuring chlorophyll, one indirectly measures the amount of photosynthesizing plants, or algae, in the water column. Chlorophyll  $\alpha$  is a measure of the portion of the pigment that is still actively photosynthesizing at the time of sampling.

**Combined Sewer Overflow (CSO):** An overflow of combined wastewater and stormwater. CSOs occur when stormwater from heavy rains exceed the capacity of the wastewater collection system.

**Dissolved Oxygen (DO):** The oxygen that is freely available in water. Certain amounts are necessary for life processes of aquatic animals. The oxygen is supplied by the photosynthesis of plants and by aeration. Oxygen is consumed by animals, plants, and bacteria that decompose dead organic matter and some chemicals.

**Effluent:** Treated or untreated water or wastewater flowing out of a treatment facility, sewer or industrial outfall. Generally refers to discharges into surface waters.

**Eutrophication:** The natural physical, chemical and biological changes that take place as nutrients, organic matter and sediment are added to a lake. When accelerated by human-caused influences, this process is called cultural eutrophication.

**Fecal Coliforms:** The intestinal bacteria from warm-blooded animals that are routinely used as an indicator of sewage pollution in water, and as an indicator of the human health risk.

**Influent:** Water, wastewater or other liquid flowing into a treatment facility.

**Lake Classification:** Lakes are typically compared according to the level of biological activity or **trophic state**. A lake with high concentrations of nutrients and algae, and with low transparency or clarity is considered **eutrophic**. Lakes with low concentrations of nutrients and algae, and high transparencies are considered **oligotrophic**. Lakes that are intermediate between eutrophic and oligotrophic are considered **mesotrophic**.

**National Pollutant Discharge Elimination System (NPDES):** NPDES comes from Section 402 of the Clean Water Act. It prohibits the discharge of pollutants into navigable waters of the United States unless a special permit is issued by the U.S. Environmental Protection Agency, a state, or tribal government.

**Nonpoint Source:** An input of pollutants into a water body from unidentifiable sources, such as agriculture, the atmosphere, stormwater or groundwater runoff.

**Nutrient:** An inorganic or organic compound essential for growth of organisms.

**Phosphorus:** The primary nutrient of concern in fresh water systems as it can cause nuisance algal blooms if present in excess amounts.

**Phytoplankton:** Marine plants, mostly small to microscopic in size, which are suspended in the water column and drift with the currents.

**Point Source:** An input of pollutants into a water body from discrete sources, such as municipal or industrial outfalls.

**Productivity:** The rate at which organic matter is formed that is averaged over a defined period of time.

**Mg/L:** Milligrams per liter. Used in describing the amount of a substance in a given volume of liquid. Equal to parts per million (ppm).

**Secchi Depth:** The measure of lake water clarity and is used primarily as an indicator of algal abundance. Clarity is affected by algae, soil particles and other materials suspended in the water.

**Thermal Stratification:** Layering of lake water caused by differences in water density. During summer months, deep lakes divide into three layers: the epilimnion (uppermost, warmest layer), hypolimnion (lower, cooler layer) and metalimnion (middle layer).

**Trophic State Index (TSI):** One of the most common lake indices used to characterize water quality is the numerical trophic state index developed by Robert Carlson in 1977. This index provides a standard measure to compare lake quality on a scale of 0 to 100. Each major division (10, 20, 30, etc.) represents a doubling of algal biomass and is related to nutrient and transparency.

**Water Column:** The area of water contained between the surface and the bottom of a water body.