NOTE: This impact assessment is based on Service Strategy 1 as presented in the Draft RWSP. See Part I of this FEIS for revised strategy descriptions and analysis.

CHAPTER 5
OPERATIONAL IMPACTS COMMON TO ALL SERVICE STRATEGIES AND IMPACTS AND MITIGATION MEASURES FOR SERVICE STRATEGY 1

Service Strategy 1 is described in Chapter 3 of this DEIS. The major features of SS1 are summarized as follows:

- Maintain the existing two-treatment-plant system (West and East Plants)
- Expand West Treatment Plant to planned capacity of 159 mgd (2020)
- Construct new parallel Kenmore interceptor (2010)
- Expand East Treatment Plant in increments to an ultimate capacity of 235 mgd (2040)
- Construct new third outfall off Duwamish Head (2000)
- Construct new parallel Eastside interceptor(2035)
- Implement CSO program to achieve one event per outfall per year by 2043
- Implement full-scale I/I reduction program

The important features of Service Strategy 1 are shown in the Figure 3-1.

CHAPTER ORGANIZATION

This chapter and the three that follow each focus on the operational impacts of one of the four service strategies, primarily treatment and conveyance and CSO control. These impacts, and proposed measures to mitigate them, are discussed under headings that correspond to SEPA "elements of the environment."

Impacts of using wastewater end products--reclaimed water and biosolids--are addressed in Chapters 9 and 10, respectively. A programmatic discussion of construction impacts is presented in Chapter 11.

The first four environmental elements discussed in each of Chapters 5 through 8 are water resources, biological resources, land and shoreline use, and environmental health. These were determined to be the more critical environmental issues in comparing the long-term impacts of the service strategies. They are discussed in greater depth than the "Other Elements of the Environment" category in the latter part of the chapter (i.e., earth resources, aesthetics, recreation, cultural and historic resources, air quality, transportation, public services and utilities, and energy). More in-depth review of all applicable elements will be conducted when individual projects under the RWSP are implemented.

In addition to those impacts specific to SS1, this chapter provides information on impacts that are common to all four service strategies. This information provides context on the general nature and extent of impacts associated with the operation of wastewater treatment, conveyance, and CSO facilities. Discussions of common impacts precede the specific discussion of SS1 impacts under each element of the environment.

WATER RESOURCES

Impacts Common to All Service Strategies

Long-term operational impacts to the water quality of receiving water bodies from the four service strategies are discussed below. These impacts involve discharges from the treatment plants and CSO outfalls, conveyance system impacts, and infiltration and inflow impacts. This discussion assumes that all facilities proposed under each service strategy will reach capacity by the end of the planning period. This assumption enables comparing the various service strategies based on cumulative effects, regardless of implementation phasing.

Treatment Plant Discharges

Treatment plant discharges will increase, regardless of the service strategy, as a direct result of expected population growth in the region during this period. Based on the region's anticipated growth, for example, AWWF for the system is expected to grow from an estimated 190 mgd in 1990 to 273 mgd by 2020.

Total discharge volumes and pollutant loads will vary by outfall (and thus by location) in Puget Sound, as well as over time for the four RWSP service strategies. All new or expanded treatment plants will be designed to comply with federal Clean Water Act requirements and, thus, will meet all applicable federal and state water quality standards.

The effect of the combined total of future King County system discharges on overall Puget Sound water quality depends on the complex interaction of discharge composition, volumes, location and depth of discharge, receiving water characteristics (such as current direction and speed) at outfall locations, and other factors. In general, total discharge volumes and pollutant loadings are similar across all service strategies; the primary differences in impacts to water resources result from the characteristics of the different water bodies that receive the discharges and the specific discharge outfall locations (see comparison in Chapter 3).

The location and depth of treatment plant outfalls in Puget Sound influence the dispersion of the effluent plume and its water quality impacts. In Puget Sound, the upper layer of relatively less dense (less saline) water tends to circulate northward and out of Puget Sound, while the lower layer of denser (more saline) water slowly moves southward (Ebbesmeyer 1994). Flushing rates between the West Point and Duwamish Head outfalls also differ, based on their relative locations in Puget Sound. The West Point outfall discharges wastewater into the upper water layer; thus, it is flushed northward out of Puget Sound. The Duwamish Head outfall discharges into the lower water layer; thus, it takes longer to disperse as the layer moves southward (Ebbesmeyer

1994). Overall water quality impacts from treatment plant discharges to Puget Sound will vary somewhat among the four service strategies based on these differences in flushing rates. Generally, service strategies that direct more treated effluent into the upper water layer of the sound create less adverse impacts. To the extent that SS2 and SS3 redirect effluent away from the Duwamish Head outfall and to a new, more northerly outfall that discharges into the upper water layer, those service strategies would be preferable from a water quality perspective.

Pollutant loadings from treatment plant discharges are expected to increase as the population grows in the King County wastewater service area. The chemical constituents in these discharges include nutrients (nitrogen and phosphorous), metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), organic compounds (total polycyclic aromatic hydrocarbons [PAH], benzyl butyl phthalate, bis/bi [2-ethylhexyl] phthalate, and benzoic acid), fecal coliform bacteria, and total suspended solids. King County's Industrial Waste Program monitors and controls the discharge of industrial wastes into the wastewater system to prevent the discharge of chemicals and other substances that may contaminate biosolids and treated effluent. In projecting pollutant loadings for the four service strategies, it has been assumed that the Industrial Waste Program will continue to operate much as it does now.

Water quality impacts near the wastewater outfalls have been evaluated for both CSO and treatment plant discharges (Hays et al., 1995). The effluent plumes from these discharges contain both dissolved ions and particulates. They are dispersed at varying distances. The heavier suspended particulates tend to settle out of the effluent plume immediately. Metals and organic compounds have a high affinity for adsorbing to sediment particles (Hays, et al., 1995). Therefore, the sediment layer near these outfall pipes may contain elevated concentrations of these metals and organic compounds. These sediments are of concern due to the environmental persistence, toxicity to aquatic life, and potential for bioaccumulation of those pollutants present (Hays et al., 1995). Dissolved ions and compounds which are adsorbed to lighter particulates tend to mix within the water column, are transported away, and do not contribute to localized impacts at the outfall (Hays, et al., 1995).

Conveyance System

Sewer systems are designed with redundancies to prevent failures. On the rare occasions when leaks or breaks occurred, potential impacts would depend on the type of pipe and the environment at the point of leakage. If the pipe was in water, sewage could escape and cause short-term, local water quality impacts. If the pipe was underground and was a gravity flow (i.e., not pressurized) pipe, little or no sewage would be likely to escape due to surrounding groundwater pressure. Groundwater would instead enter the pipe and be conveyed with the sewage. If the pipe was a force main (i.e., pressurized flow pipe) sewage could be forced out of the pipe and enter groundwater and potentially surface water. The resulting loss of pressure would be quickly detected at a pump station and repairs effected. Mechanical or electrical failures could also cause wastewater overflows to surface water. In all cases sewage spills would be detected and repaired quickly so any water quality impacts would be temporary and localized.

Impacts Specific to SS1

West Service Area Treatment and Conveyance

The volume of wastewater effluent discharged from the West Plant would increase under SS1 based on expansion of this facility to 159 mgd. This increased discharge would result in operational impacts on water quality in Puget Sound off West Point. Pollutant loading rates are expected to increase in Puget Sound for nutrients, metals, organic compounds, fecal coliform bacteria, and total suspended solids. As described above, the West Treatment Plant discharges effluent into the upper water layer, where it is flushed northward out of Puget Sound.

Operational impacts of conveyance pipelines would be limited to localized temporary water quality impacts associated with accidental leakage. See discussion under "Conveyance System," earlier in this chapter.

East Service Area Treatment and Conveyance

Expanding the East Plant to 235 mgd would approximately double the treated wastewater effluent discharged to Puget Sound off Duwamish Head. Pollutant loading rates are expected to increase for nutrients, metals, organic compounds, fecal coliform bacteria, and total suspended solids. As noted previously, because the East Treatment Plant outfall discharges into the deeper waters of Puget Sound, this effluent would tend to move southward farther into the sound. Thus, dispersion would take somewhat longer than for effluent discharged into shallower waters of the sound (e.g., the West Point outfall).

CSOs

The CSO program for SS1 would achieve the one-overflow-per-year goal by 2043. The program would be phased to complete projects on Puget Sound beaches and the East Ship Canal first, followed in later years by projects along the Duwamish River and the West Ship Canal. The individual projects north of the Ship Canal would generally store CSO volumes for later conveyance to the West Treatment Plant for secondary treatment after peak flows subside. For CSOs south of the Ship Canal, the SS1 program would generally store CSOs and provide onsite treatment at CSO locations. The program would benefit water quality for Puget Sound beaches, the Ship Canal, and the Duwamish River.

Infiltration/Inflow

SS1 includes an aggressive program for I/I reduction. A 30 percent reduction in I/I for all basins of the service area would result in more efficient treatment of sanitary wastewater flows at the treatment facilities (i.e., less-diluted wastewater would enter the WWTP facilities). Groundwater which presently enters conveyance lines would be excluded with I/I control and, thus, might increase the local groundwater elevation in some areas.

Mitigation Measures

Potential adverse impacts to water resources from operation of all the wastewater facilities proposed under the RWSP could be avoided or minimized through careful design and maintenance. Based on identification of environmentally sensitive areas in the

King County service area, impacts would be avoided wherever feasible. Where this was not possible, impacts would be minimized to the greatest extent practicable. The following mitigation measures could be used to avoid or minimize impacts to water resources.

- Select outfall sites with strong currents and favorable circulation patterns that most rapidly move pollutants northward out of Puget Sound. Research indicates that the upper water layer best provides these conditions. Outfall locations that meet these criteria would reduce long-term operational impacts.

- Infiltration and inflow control projects in flood-prone areas would include studies of local groundwater and surface water drainage patterns to avoid exacerbating local flooding and wet basements.

- King County's Industrial Waste/Source Control Pretreatment Program reduces the levels of contaminants entering the sewer system and enhances both biosolids and reclaimed water products.

- Use appropriate procedures for handling chemicals and petroleum products during facility operation. This includes proper storage, use, and cleanup of these materials.

- Design and implement the CSO reduction program to maximize benefits to receiving waters.

- Maintain and operate treatment plants to meet permitted discharge requirements, including proper functioning of the outfall.

Unavoidable Adverse Impacts

The increase in volumes of wastewater treated under any of the service strategies would increase loadings in Puget Sound for pollutants from wastewater treatment plant discharges.

BIOLOGICAL RESOURCES

Impacts Common to All Service Strategies

Operational impacts to biological resources common to all four service strategies are generally related to population growth in the King County Service Area. Increased wastewater flows will raise pollutant loadings to marine waters from new or expanded treatment plants, as discussed in the previous section, "Water Resources." These increased loadings, in turn, would result in generally localized impacts near the outfalls. The extent of adverse impact on the marine environment will depend on outfall discharge volumes and location. Biological resources, including fish and shellfish, can be affected either through physical changes in their environment (sediment size, water temperature, and levels of dissolved oxygen), or through chemical toxicity associated with contami-

nants in the water column and sediments. Some contaminants, including metals and toxic organics, can be conveyed through wastewater discharges. The complexity of aquatic ecosystems makes generalization difficult. Thus, additional baseline research would be needed, particularly during siting of potential new outfalls off Duwamish Head and the north King or south Snohomish County shoreline, before making final decisions on outfall locations and depths. This additional analysis would be conducted at the same time as the preliminary engineering design during project-level environmental review. Design and operation of the system's treatment plants and outfalls would comply with federal and state water and sediment quality standards. This would minimize impacts on the biological resources of the marine environment.

New or expanded treatment plants and their associated facilities could also result in some habitat loss or conversion, particularly for construction of a new North Treatment Plant at an inland undeveloped location (SS2 and SS3). Other wastewater treatment and conveyance facility impacts on biological resources are minimal.

Reduction or elimination of CSOs as part of service strategies would benefit fish and shellfish populations; improve foraging habitat for shorebirds, raptors, waterfowl, and other water-dependent birds; and improve conditions for other wildlife dependent on aquatic habitats. Cleaner water would contribute to productivity of food sources such as crustaceans, invertebrates, and aquatic plants. Chronic pollutant loadings to fish habitat, the potential exposure of fish to contaminants, ingestion of or entanglement in floatable material, and the likelihood of exposure to dissolved oxygen “sags” following CSO events would all be reduced.

Potential adverse operational impacts include accidental spills of diluted or undiluted sewage or other waste materials into water bodies if a pipeline or CSO storage facility leaked, particularly in cases where pipelines cross streams or pass through water bodies. Such accidental spills differ from CSOs in that they are rare and temporary and can be corrected quickly. If such spills do occur, they typically do not result in specific adverse impacts to biological resources because the waste is further diluted by entering a large body of water.

Impacts Specific to SS1

West Service Area Treatment and Conveyance

SS1 includes expansions of the West Plant, increased discharge volumes, and added pollutant loadings from the existing outfall off West Point. Impacts to biological resources near the outfall would be as described above. The increased discharge to Puget Sound would be designed to meet all applicable water quality and sediment standards. These standards have been developed to minimize adverse impacts on marine waters, including on fish, shellfish, eelgrass, kelp, and other marine resources in the waters of western Washington. Consequently, an increase in the discharge off West Point is not expected to result in significant adverse impacts on the biological resources of Elliott Bay and central Puget Sound.

East Service Area Treatment and Conveyance

SS1 includes construction of a new third leg of the outfall off Duwamish Head to accommodate increased discharges from the East Treatment Plant. Because this would entail siting a new outfall location, additional baseline studies would be required near the new outfall to identify fish and shellfish populations potentially at risk from discharge. Disturbance of identified fish and shellfish resources would have to be minimized. Increased discharge is not expected to have any direct impact on marine mammals. There may be minor impacts on fish that are prey species of marine wildlife; however, this would not be expected to affect marine wildlife population levels in the area. The outfall would be designed to allow tide and water currents to flush discharged effluent from the outfall area quickly. All state and federal chronic and acute water quality and sediment management standards for discharge would be met.

CSOs and Inflow/Infiltration

Impacts for CSO and I/I project operation on biological resources would generally be minimal. Aquatic resources in the vicinity of CSO outfalls would likely benefit from the reduction in contaminant discharges associated with CSO reductions (see Water Resources discussion above).

Mitigation Measures

- Where feasible, native vegetation would be planted around new facilities to provide noise and visual buffers between the facility and any adjacent wildlife habitat.

- Outfalls would be sited to minimize adverse impacts to biological resources.

Unavoidable Adverse Impacts

Increases in outfall discharges would unavoidably disturb or displace marine biota over a small area near the discharge point.

LAND AND SHORELINE USE

Impacts Common to All Service Strategies

All four service strategies would provide adequate wastewater conveyance and treatment capacity to accommodate the population growth anticipated in the King County Comprehensive Plan. Each strategy would provide capital facilities prior to or concurrent with growth occurring inside the County's designated Urban Growth Area. Changes to planned regional land use patterns would not be caused by implementation of any of the service strategies. Each strategy is consistent with the Comprehensive Plan and the Growth Management Act.

Impacts Specific to SS1

Consistency with Policies and Regulations

Growth Management Act and Local Comprehensive Plans. The State of Washington and King and Snohomish Counties have prepared population and employment projections as part of the growth management process. These projections, which include information on geographic distribution, have provided the basis in the RWSP to determine future flows into the King County system (refer to the RWSP for a detailed discussion of flow projections). The timing, sizing, and location of proposed facilities under SS1 were developed to provide adequate capacity to handle these expected wastewater flows. This service strategy does not include the capacity to handle wastewater flows generated outside the King County wastewater service area, including flows generated within isolated urban growth areas such as those in the Snoqualmie River Valley. For these reasons, SS1 is consistent with the GMA.

Local comprehensive plans for counties and cities within the King County wastewater service area have been prepared in conformance with the GMA. SS1, through conformance with the overall growth management process, is also consistent with the goals and policies for utility service levels in local comprehensive plans. In addition, because the timing, sizing, and location of proposed facilities are based on population and employment projections that are also used as a basis for development of local comprehensive plans, this service strategy is consistent with the growth management requirement for concurrency (i.e., the availability of necessary utilities and other infrastructure and services concurrent with development that depends on the infrastructure and services).

Shoreline Management Act. A number of major facilities, particularly CSO control facilities, proposed for SS1 are in designated shoreline areas and would require shoreline permits. In most jurisdictions and shoreline environments, wastewater treatment plants and associated conveyances and other facilities are not prohibited. However, because wastewater facilities (except for outfalls) are not considered water-dependent uses, a demonstration of public benefit and need for the particular shoreline location is typically required before a shoreline permit is granted. Such a demonstration of benefit and need would be required for in-water placement of the Kenmore Parallel Interceptor and expansion of the West Plant. In addition, conditions are usually attached to permit approvals specifying public access requirements, landscaping and visual mitigation, and other performance standards. These permit conditions would likely apply to facilities in the shoreline zone for SS1.

Zoning. The West Treatment Plant at West Point is located in a single-family zone (SF 7200) and requires a Council Conditional Use permit to be expanded. Land use and shoreline permits were obtained for the recently completed conversion of the plant to secondary treatment, but the process was difficult and lengthy. From a permitting perspective, expanding the plant's capacity to 159 mgd is likely to be complex and controversial, as well.

The East Treatment Plant is located in a Renton public zone, so plant expansion would be permitted subject to site plan review to ensure compliance with city zoning requirements and compatibility with surrounding land uses.

The numerous individual pump stations, conveyance lines, and storage facilities proposed under SS1 are usually classified as utilities. They are generally permitted, either outright, or by granting a special use, unclassified use, or similar land use permit. Where such a land use permit is required, landscaping or siting requirements and other performance standards are included as permit conditions to ensure compatibility with surrounding land uses.

Direct Land Use Impacts

West Service Area Treatment and Conveyance. SS1 would expand the West Treatment Plant at West Point from its current 133-mgd capacity to a proposed 159-mgd capacity by 2020. Compliance with the terms of the treatment plant's existing land use permit and the 1991 Settlement Agreement would require no expansion outside the plant's 32-acre footprint and no increase in pollutant loading to Puget Sound beyond the level permitted for a 133-mgd plant, even if plant capacity is increased.

Complying with those conditions, plant expansion would intensify the current land use, within existing plant boundaries. Facilities could be constructed closer to the site's perimeter, for example, or could be enlarged from their current size. Although the original treatment plant preceded the establishment of Discovery Park, many perceive the current plant as incompatible with surrounding recreational uses and would likely see an expansion as a worsening of current conditions.

Because of concerns about odors, noise, and visual character, nearby residents and businesses may perceive pumping stations as incompatible with surrounding land uses.

East Service Area Treatment and Conveyance. The expanded East Treatment Plant would be located in a highly urbanized industrial/commercial area. With continuation of the existing site design features and extension of perimeter buffering, the expanded plant would be compatible with surrounding land uses.

CSO and Infiltration/Inflow. Underground conveyances and storage facilities (both wastewater and CSO) would be compatible with surrounding land uses. CSO treatment facilities would be located along the Duwamish Waterway and the Elliott Bay shoreline in highly urbanized areas; therefore, these facilities are likely to be compatible with surrounding land uses.

No long-term land use impacts result from the I/I program.

Mitigation Measures

The nature of nearby land uses and natural environmental features would be considered during site selection and design processes to promote consistency with local comprehensive plans and compatibility with adjacent land uses. Land use consistency and compatibility would also be promoted by including appropriate design features (odor and noise control, for example), coupled with an appropriate degree of perimeter buffering.

Unavoidable Adverse Impacts

Expansion of the capacity of the West Treatment Plant within the existing plant boundary may be perceived by some as incompatible with surrounding recreational uses.

ENVIRONMENTAL HEALTH

As defined by SEPA, the term "environmental health" covers several types of impacts with the potential to affect human health and well-being. These impacts are those that are not covered under other areas of SEPA and/or are not specifically addressed by protective regulations. Water and air quality, for example, have the potential to affect human health; however, they are separate SEPA "elements of the environment" and are regulated by standards expressly designed to minimize possible health effects.

For the RWSP, this section covers three topics related to environmental health: public health, noise, and hazardous materials. Public health is specifically related to CSO discharges, which–though short-term and infrequent–are not subject to pollutant discharge limitations under state and federal water quality regulations.[1] Therefore, direct human contact with these discharges, as well as ingestion of shell-fish exposed to them, is a public health issue. Noise is generated by wastewater treatment facilities and pump stations, and is generally restricted to prescribed levels by local ordinances to protect receptors. Hazardous Materials (as specified by state and federal regulations) are used in various treatment processes and are transported to, and stored on, treatment plant sites.

Not all of these environmental health issues are applicable to all service areas or system components. Therefore, this section is organized to focus only on those service areas or components in which impacts may occur. In the case of noise, all impacts described are common to the four service categories.

Public Health

Impacts Common to All Service Strategies

King County will continue to plan and carry out CSO control projects to work toward achieving the EPA goal of four to six events per outfall per year and subsequently to achieving Ecology's standard of one event per outfall per year. CSOs would be stored and subsequently would undergo either secondary treatment at the West or East Treatment Plants or onsite treatment before direct discharge. Overflows at existing CSO locations along pipeline routes would not increase.

[1] Regulation of CSOs by Ecology and EPA limits the **frequency** of discharge rather than the pollutant levels, which may vary according to many factors. For further discussion of CSO issues see Chapter 2, Background.

Direct human contact with the CSO pollutants can occur during water-based activities such as swimming, wading, boating, or scuba diving. Reduction in the frequency and volume of discharges would substantially lower the potential for human exposure to harmful bacteria, viruses, metals, and petroleum products contained in CSOs. CSO reductions could reduce human health risks in areas where overflows discharge near areas of heavy human use such as parks, beaches, and other public access points. The County is currently preparing a CSO water quality assessment to evaluate the human health benefits of CSO reduction.

Mitigation Measures

The proposed reductions in CSO discharge represent a substantial improvement over existing conditions and will reduce regional public health risks. No mitigation is necessary.

Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur.

Noise

Impacts Common to All Service Strategies

Operation of wastewater treatment plants, pump stations, and regulator stations creates varying levels of noise that can disturb adjacent properties, depending on the type and proximity of the receptor. All wastewater treatment plants would be designed to contain noise, particularly when there are nearby sensitive land uses (e.g., residential). Most noise-emitting equipment would be located in buildings, reducing noise levels to acceptable limits before reaching the property line. Fan openings could be directed away from sensitive receptors. Noise levels would be in compliance with the limits established by local jurisdictions.

If necessary, pump stations would be designed with noise baffles to supply enough dead air space between the noise and the outside wall of the building to minimize noise emissions to the exterior. Depending on project-specific design, pump stations could be equipped with emergency diesel generators for use in case of power outages. These generators have high noise levels and would be tested monthly for about 30 minutes. Pump stations served by dual power feeds do not usually have emergency generators. Any noise impacts would be temporary.

Impacts Specific to Service Strategy 1

Noise from trucks traveling to and from treatment plants may reach sensitive receptors, depending upon surrounding land uses. For example, the West Plant is accessed by a road that passes residences and through Discovery Park. The East Plant access road passes industrial and business park uses.

Mitigation Measures

With proposed noise reduction techniques, as described above, incorporated into facility design, no exceedances of local noise standards are expected to occur. No mitigation is required.

Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur.

Hazardous Materials

Impacts Common to All Service Strategies

Providing secondary treatment for increased wastewater flows would require the use of more chlorine than is currently used at either the West or East Treatment Plants. Increased risks to environmental health are unlikely. Buildings at either plant where chlorine is stored are designed to contain spills and are equipped with automated alarm systems to minimize fire danger in accordance with the Uniform Fire Code. In addition, King County has extensive operating experience using chlorine and has developed safety measures and response plans to minimize risk to public health.

Chemicals used at pump stations to control odor and corrosion can be hazardous and require special storage and handling procedures. These chemicals are usually stored in containers, isolated from other areas within the pump station, and added to the wet well and/or force main under controlled conditions. Because of the safety features incorporated into the design of pump stations, control systems and alarms, and King County's experience with hazardous chemicals, impacts on environmental health associated with use of chemicals at pump stations are not expected to be significant.

Impacts Specific to Service Strategy 1

West Service Area. Chlorine is transported to the West Treatment Plant in 1-ton cylinders, typically in 12-cylinder lots, every 3 to 4 days. Chlorine use at the plant averages 3 to 4 tons per day. The Chlorine Institute reports that there have been no instances of chlorine emissions from 1-ton cylinders during delivery in over 40 years (Metro, 1988). There was an accidental leak of chlorine at the West Treatment Plant in 1966 before many of the current-day safeguards were instituted. Chlorine gas was dispersed over Puget Sound without adverse effects on environmental health. With the design and safety measures discussed above, there would be no substantial increase in environmental health risks associated with plant expansion.

Caustic soda is stored onsite for use as an absorbent for chlorine, should a leak occur. Venting systems direct any chlorine gas to caustic soda tanks where the gas is absorbed and neutralized. When combined, chlorine and caustic soda produce salt water. Caustic soda use is very low; between 1978 and 1988 there were only two deliveries to the West Treatment Plant. Caustic soda is stored in large storage tanks surrounded by concrete berms to contain any leaks or spills. The potential for adverse impacts to public health is low.

Chlorine is also used for disinfection at the Alki and Carkeek plants. These plants are used to store and treat CSOs during storm events and are also designed to contain accidental releases and equipped to minimize fires.

East Service Area. Chlorine is transported to the East Treatment Plant in rail cars. The risks associated with rail transport of chlorine were analyzed in a 1980 study for the U.S. Department of Energy. The annual risk of a fatality from a chlorine rail car accident nationwide is about 1 in 22 million. This compares to motor vehicle accident and fire fatality risks of one in 4,000 and one in 32,000, respectively. Tank car accidents have been reported in the State of Washington involving chlorine (Metro, 1991). The low risk of rail car accidents is further reduced by the safety features incorporated into onsite chlorine systems, including containment structures, leak detection and alarm systems, vacuum distribution systems, and emergency response plans.

Expansion of the East Treatment Plant would incorporate the same safety features, alarm systems, and response plans used at the existing plant. While chlorine use would increase, roughly in proportion to the size of the expansion, the risk to environmental health would remain low.

Caustic soda use at the East Treatment Plant is similar to that described above for the West Treatment Plant. The potential for impact on public health is similarly low.

Mitigation Measures

- At each wastewater treatment plant, safety plans would continue to be implemented to minimize risks associated with hazardous materials and chemicals. Emergency response plans detail measures to be taken in the event of an emergency involving hazardous materials or chemicals. Workers receive regular training in the use of these materials, as well as in emergency response procedures.

- All facilities would be designed to minimize the potential for leaks or breaks. To prevent pipeline or facility leakage, King County conducts periodic routine pipeline inspections to examine pipes for possible defects. Inspections detect potential for failures before the failure is imminent. Should a leak occur, an emergency response team is mobilized so that repairs and cleanup begin immediately. Appropriate regulatory agencies, including EPA, Ecology, and the local jurisdiction in which the spill occurs, are notified.

- Chlorine would continue to be stored in concrete storage buildings designed to fully contain chlorine in the event of a leak; pressure sensors and leak detection alarms would also be provided.

- Vacuum distribution systems would be used for chlorine; these systems include fail-safe shutdown in the case of vacuum system failure.

- Sodium hydroxide would be used in emergencies to absorb chlorine in case of system malfunction.

- Chlorinated systems would be inspected regularly.

- Caustic soda storage tanks would be provided with concrete berms to contain any releases from leaks or ruptures.

- Chemicals, paints, solvents, lubricants, etc. would be stored in structures designed to contain any leakage or rupture.

Unavoidable Adverse Impacts

None identified.

OTHER ELEMENTS OF THE ENVIRONMENT

Earth Resources

Impacts Common to All Service Strategies

All service strategies include projects that would convert existing native soils to impervious surface. Such conversion increases surface water flows and runoff rates and corresponding erosion; it also impedes local aquifer recharge. In general, however, overall increases in impervious surface would be small.

Major earthquakes occur in the Puget Sound region and could result in structural damage to treatment and conveyance facilities. All structures proposed in identified seismic risk areas would be designed to withstand earthquake effects to the levels identified in applicable policies and regulations.

Increased control of CSOs will reduce deposition of contaminants in sediments near outfalls.

Impacts Specific to Service Strategy 1

New conveyances and CSO facilities would contribute minor amounts of additional impervious surface area. Expanding the East and West Treatment Plants would result in the following estimated additional impervious surface areas:

- East Treatment Plant expansion—40 to 45 acres
- West Treatment Plant expansion—1.5 acres

Impacts on earth resources from proposed facilities would not be significant. A high magnitude earthquake could result in structural damage to the East Treatment Plant, which is located in an area subject to liquefaction during seismic activity.

Mitigation Measures

Structures located in high seismic risk areas would be designed to withstand 0.3-ground acceleration, consistent with current King County policy. Where practical, soils subject to liquefaction could be overexcavated down to firmer materials.

Unavoidable Adverse Impacts

None identified.

Aesthetics

Impacts Common To All Service Strategies

The construction of new aboveground facilities (primarily treatment plants and pump stations) would change the visual character of the surrounding landscape to a greater or lesser degree, depending on the nature of local land uses, the size of the facility in question, and the techniques (e.g., landscaping) used to screen and buffer the facility from its neighbors. Specific impacts are described for each service strategy in the applicable section.

Impacts Specific to Service Strategy 1

Additional facilities at the West Treatment Plant would be located within existing plant boundaries. Additional structures, which would be lower than most of the existing plant buildings, would result in an overall facility that is slightly more visible than the existing facility. Expansion of the East Treatment Plant would double the size of the existing plant. The expanded new plant, however, would have a visual character similar to the surrounding industrial and office development. The expanded plant size would make the facility more visible from nearby viewpoints and distant valley residences.

No adverse aesthetic impacts would result from the operation of underground facilities (i.e., conveyances and tunnels).

Pump stations are small structures similar to, or smaller in scale than, nearby residential, commercial, or industrial structures. They consist of several thousand square feet or less and are one to two stories high. Their utilitarian character and specialized odor equipment can make pump stations visually prominent. Because they are small structures, however, these facilities are usually seen only from nearby locations, so visual impacts are not expected to be significant.

Mitigation Measures

Existing berming, landscaping, and other visual mitigation measures at the West Treatment Plant would be sufficient to mitigate any adverse aesthetic impacts of an expanded facility.

To mitigate adverse visual impacts resulting from an expanded East Treatment Plant, the extensive mitigation measures employed at the existing treatment plant could be expanded to include the new structures. These mitigation measures include perimeter berming, perimeter and interior landscaping with native materials, and siting of facilities to direct views into the site toward open areas and away from structures.

For pump stations located at sites visible from nearby properties, landscaping could be provided to obscure the visibility of the facility.

Unavoidable Adverse Impacts

New pump stations would result in minor changes to the visual character of the immediate areas.

Recreation

Impacts Common to All Service Strategies

Operational impacts on recreation would occur if aboveground structures were located within or close to recreational facilities, such as parks. Such impacts could be direct (i.e., lost use of park lands or amenities) or indirect (e.g., aesthetic or noise impacts). Impacts of specific service strategies are discussed in the applicable chapters.

Impacts Specific to Service Strategy 1

The addition of 26 mgd of capacity to the West Treatment Plant would not result in new permanent wastewater facilities outside plant boundaries. However one plant area reserved for future facilities is currently in recreational use and that would be taken for the expanded plant. Expansion of the East Treatment Plant would not result in the loss of any land used for recreation. Adverse post-construction impacts on recreation resulting from treatment plant expansion would be minimal.

Underground facilities (conveyances and tunnels) would not result in any post-construction adverse impacts on recreation.

Expansion of the Matthews Beach pump station, in conjunction with construction of the Kenmore interceptor parallel, could result in the loss of minor areas in Matthews Beach Park. The Murray Avenue CSO control project could eliminate some recreational space at Lowman Beach Park.

Implementation of the I/I program would probably not result in any recreation impacts.

Mitigation Measures

No significant adverse impacts to recreation are expected, and no mitigation measures would be necessary.

Unavoidable Adverse Impacts

None identified.

Cultural and Historic Resources

Except for potential minor soil disturbances associated with system maintenance, no activities related to the operation of RWSP facilities are expected to result in impacts to cultural or historic resources under any of the service strategies. Potential construction impacts are discussed in Chapter 11.

Air Quality

Impacts Common to All Service Strategies

Volatile Organic Compounds. As described in Chapter 4, VOC emissions from treatment plants are essentially proportional to the volume of wastewater treated. In general, the VOC emission potential of enclosed treatment processes, such as high-purity oxygen treatment, is considerably less than that of unenclosed treatment processes because of the limited potential for VOCs to volatilize into the ambient atmosphere. However, enclosed processes are generally more expensive initially and may not be practical or cost-effective for many municipal treatment needs. Activated sludge and trickling filter processes are estimated to have about an equal potential for releasing VOCs from wastewater.

Handling biosolids on the treatment plant site also poses the potential for release of VOCs that remain after completion of the liquid process. Again, enclosed solids handling facilities minimize this potential, but the space required for dewatering, storage, and other activities may make this impractical. Where anaerobic digestion of solids is accompanied by combustion of resulting digester gas, VOCs can be emitted during combustion.

Because all of the system service strategies under consideration are based on the same set of population and demand projections, they all involve treating roughly equivalent volumes of wastewater at any point on the planning horizon. Concentrations of VOCs in influent are expected to remain relatively consistent from one treatment facility to the next, as has been the case in earlier test results. Although the specific treatment processes used for new or expanded facilities will, as discussed above, result in slight variations in VOC emission rates, the primary determinant of emissions will be the volume of wastewater treated. Since this volume is approximately equal for all service strategies, VOC impacts are expected to be similar for any service strategy chosen.

Combustion Pollutants. Burning of digester gas to produce electricity produces nitrogen oxides and carbon monoxide emissions at the West Treatment Plant. Increased production and digestion of biosolids would result in increased emissions of these pollutants if the additional digester gas were also used in electrical generation. Air quality impacts related to biosolids application are discussed in Chapter 10 of this DEIS.

The need to treat larger quantities of wastewater through the operation of new or expanded treatment facilities will result in the generation of additional traffic. Estimates of trip generation for each service strategy are provided in the chapter addressing that service strategy. Levels of ambient CO along local truck routes would increase as a result of the additional vehicle trips; impacts of the selected service strategy will be analyzed in greater detail in subsequent project-level environmental review. Overall, however, impacts of projects included in the plan will be minimal in relation to regional CO emissions from motor vehicles.

Odor. The factors influencing a treatment facility's odor impacts are similar in many ways to those that determine its level of VOC emissions. Elements of a facility most likely to generate odors typically are not enclosed and, thus, expose wastewater or solids to open air. The highest potential sources of odor include the screenings building, sludge digester, sludge thickener, and the septage receiving and loading areas. Primary clarifiers

have a moderate odor potential, while aeration basins and secondary clarifiers tend to produce few odors. Also, as with VOCs, treatment processes vary in their odor-causing potential. Trickling-filter processes have the highest potential for odor, followed by activated sludge and oxidation ditch processes. Processes with the lowest odor potential include rotating biological contactors and high-purity oxygen-activated sludge. Specific facility elements and treatment processes for the selected strategy will be determined at the project level, with further environmental review occurring, as necessary.

Other facilities related to the conveyance of wastewater can generate odors similar to those experienced at treatment plants. Typically, odors are generated where wastewater becomes turbulent, such as at pump or regulator stations. Odors can also be present at high spots in conveyance pipelines, usually where force mains and gravity mains come together. Facilities can be designed to incorporate odor controls, such as carbon filters, to treat air before it is emitted to the environment.

Impacts Specific to Service Strategy 1

VOC impacts of SS1 would be essentially the same as described above under "Impacts Common to All Service Strategies."

SS1 includes expansion of the East Treatment Plant to 154 mgd by 2010. This expansion, along with successive expansions through 2040 and completion of the West Plant expansion in 2020, will present a greater potential for odor generation because of the larger volumes of wastewater treated. Since existing processes and operations are proposed to remain essentially the same, the sources and chemical constituents of potential odors would remain as they are now. This potential would be generally proportional to the volumes treated; however, since the treatment process currently used at the West Treatment Plant has less odor generation potential than the process used at the East Treatment Plant, impacts for equal volumes of wastewater would be somewhat higher at the East than at the West Treatment Plant. The West Plant is located near sensitive odor receptors including residential areas and Discovery Park. Future expansion of the East Treatment Plant would further increase the potential for odor generation, and infill of the area could increase the number of sensitive receptors.

New pump stations or increased flows through existing pump stations would also have the potential to result in odor emissions in the immediate vicinity. Odor impacts from pump stations are typically much less than those from treatment facilities, although odors can be associated with occasional venting that occurs from the pump stations.

Mitigation Measures

VOC (excluding toxic air contaminants (TAC)) and odor emissions from wastewater treatment facilities are not subject to regulation by PSAPCA or other agencies. However, King County actively pursues measures to reduce such emissions at its facilities. Ongoing source control efforts are the single most effective method of reducing the range and concentrations of VOCs in wastewater influent. Odor control at the expanded treatment facilities would involve extending technologies currently in use to the newly constructed expansion areas. Chapter 4, Affected Environment, describes some of the types of technologies currently used to control odor at King County facilities.

In addition, King County will continue to seek practical technologies that will prevent odors from escaping wastewater facilities.

Unavoidable Adverse Impacts

Regional levels of VOC emissions would increase slightly under any of the service strategies. Odor potential would increase in the immediate vicinity of the East and West Treatment Plants under SS1.

Transportation

Impacts Common to All Service Strategies

Operation of expanded treatment facilities would require several additional treatment plant operating staff members. Some staff members would be headquartered at the plant sites for functions such as facilities maintenance, administration, and site maintenance. Additional worker trips to and from the site would not occur during the morning and afternoon peak traffic periods. Most trips would occur during the day, although additional swing and graveyard shifts could be added at night.

The new and expanded pump stations proposed under each service strategy would not be staffed. Workers based at other facilities would visit each of them every 1 or 2 weeks. If repair or equipment replacement were needed, more traffic would be generated for the duration of those activities. Otherwise, very few additional trips would be generated by new or expanded pump stations. Other impacts of SS1 would be as described above under "Impacts Common to All Service Strategies."

Pipelines are inspected only periodically. Virtually no traffic would be generated by pipelines once construction was complete. Similarly, CSO control facilities would have no permanent staff. During some storm events, two to three staff based at either plant would make trips to the CSO facilities to ensure they were operating properly.

Impacts Specific to Service Strategy 1

For SS1, estimated vehicle trips generated by various operational activities are shown in Table 5-1. Projected numbers for future plant expansions have been scaled from current plant information and, in general, are considered conservative estimates. Other impacts of SS1 would be as described under "Impacts Common to All Service Strategies."

Mitigation Measures

No mitigation measures are proposed. However, King County continues to evaluate solids processing technologies that would reduce biosolids volumes and thus hauling trips.

Unavoidable Adverse Impacts

None anticipated.

NOTE: Table EP2-6, Chapter EP-2, provides operational trips for revised Service Strategy 1.

Table 5-1
Operational Trips (1)
Service Strategy 1

Vehicle Type	Facility					
	West Plant		**East Plant**			
	Existing, (133 mgd)	(159 mgd)	Existing, (115 mgd)	(154 mgd)	(191 mgd)	(235 mgd)
Septage Trucks	----------	----------	60/day	85/day	100/day	120/day
Screen/Grit Trucks	12/week	15/week	8/week	11/week	13/week	16/week
Process Chemicals	40-50/month	50-60/month	0-10/month	0-14/month	0-17/month	1-20/month
County Trucks and Cars	8/day	10/day	60/day	85/day	100/day	120/day
Employees						
Shift Crew	80/day	100/day	70/day	100/day	115/day	145/day
All Others (Mon. - Fri.)	160/day	190/day	200/day	280/day	330/day	410/day
Visitors	50/month	60/month	NA(3)	NA	NA	NA
Biosolids Trucks (2) (7 days a week)	14/day (7 loads)	Maximum of (13 loads)	10/day (5 loads)	14/day (7 loads)	16/day (8 loads)	20/day (10 loads)
Chlorine Railroad Cars	--------	--------	7/year	10/year	12/year	14/year

Notes: (1) Trips are one-way; figures are rounded. "One-way" is defined as a single direction trip to a single destination.
(2) Biosolids truck trips are one-way. Final conditions to the Shoreline Substantial Development Permit for upgrade to secondary treatment at West Point state that "the number of loaded sludge trucks shall not exceed 13 per day on average over a year period (January through December)." Thirteen truck loads per day equals 26 one-way truck trips as defined in Note (1).
(3) Data not available.

Public Services, Utilities, and Energy

Impacts Common to All Service Strategies

The principal utilities affected by operation of proposed facilities would be electrical power and natural gas suppliers. Treatment plants and pump stations are the facilities that would consume most of the energy required for operation under any of the service strategies. Methane and other gases produced at treatment plants could be captured and sold to Puget Sound Energy or used to generate power to reduce demand placed on suppliers.

The additional amount of energy consumed would be minor in the regional context. Energy requirements of individual facilities would be evaluated in light of available power supply during facility design.

Operation is unlikely to have a significant impact on police, fire, and emergency services. Demands on water, telephone, and other utilities are unlikely to be significant.

Impacts Specific to Service Strategy 1

The additional electrical energy required to operate treatment plants in the year 2030 is estimated at 33.7 million kWh per year. The amount of energy produced to offset this demand has not been estimated.

Mitigation Measures

Local utilities attempt to meet the demands of their customers. More detailed environmental reviews of individual projects proposed as a result of this planning process would include assessments of possible impacts to services, utilities, and energy and any appropriate mitigation measures.

Unavoidable Adverse Impacts

None anticipated.