3.5 Water Quality

3.5 Water Quality

3.5.1 Studies and Coordination

This section is based on the findings of the *SR 509/South Access Road EIS Discipline Report: Water Quality* (CH2M HILL August 2000), *SR 509/South Access Road EIS: South Airport Link* (August 2001a), and *SR 509/South Access Road EIS: I-5 Improvements Report* (CH2M HILL October 2001). The discipline reports, which are included in this FEIS by reference, evaluated previous technical studies, engineering reports, basin plans, and topographic and natural resource maps to assess resources that could be affected by the proposed project. Identifying and evaluating potential impacts resulting from the proposed project alternatives also required coordinating with project consultants and representatives from natural resource management and regulatory agencies. The following agencies and jurisdictions were contacted during preparation of this FEIS:

- U.S. EPA, Seattle Office, Region 10
- U.S. Department of Agriculture
- National Marine Fisheries Service
- Federal Aviation Administration
- Washington State Department of Ecology (Ecology), Northwest Regional Office, Bellevue
- WSDOT
- King County Department of Natural Resources, Water and Land Resources Division
- King County Department of Metropolitan Services
- Highline Water District
- City of Federal Way, Water and Sewer Department
- City of Des Moines, Public Works Department
- City of SeaTac, Public Works Department
- City of Kent, Public Works Department

- Port of Seattle

Methods

For this analysis, the project area includes all basins or watersheds potentially affected by this project (Figure 3.5-1). Information on drainage patterns, riparian land uses, riparian conditions, channel conditions, and hydrology in the project vicinity was augmented by field observations made during a jurisdictional wetland delineation and stream reconnaissance investigation. No water quality or flow data were collected.

Potential operational or long-term effects on surface waters from the build alternatives were evaluated. Using the FHWA procedure (FHWA April 1990a, April 1990b), the probabilities of exceeding ambient background concentrations and Washington State Class A standards prior to any water quality treatment were estimated for each of the build alternatives. The FHWA procedure, which has been adopted by WSDOT, is a probabilistic dilution model developed and applied in EPA's Nationwide Urban Runoff Program (NURP). For each of the surface water basins affected by the proposed project alternatives, pollutant loadings for total suspended solids (TSS), chemical oxygen demand (COD), zinc, copper, nitrate/nitrite, total Kjeldahl nitrogen (TKN), and total phosphorus (TP) were estimated for the new roadway surfaces, before treatment, relative to background conditions. These pollutant concentrations were compared to threshold values, below which no stormwater treatment would be required.

Final pollutant concentrations and annual mass loading after treatment at various best management practices (BMPs) were estimated using the FHWA (1996) procedure. Pollutant concentrations from new roadway surfaces were computed for TSS, zinc, TKN, and TP. Treatment efficiencies of selected water quality treatment facilities were computed following median removal rates suggested in the WSDOT Instructional Letter No. IL 4020.00, Enclosure C (WSDOT 1999) and in FHWA (1996) (Table 3.5-1) and in the Surface Water Design Manual (King County 1998).

Table 3.5-1
WSDOT Best Management Practices Effectiveness Rates

BMP[a]	Treatment Efficiency (%)			
	TSS	TKN	TP	Zinc
Wet Vault	23	5	5	5
Biofiltration Swale	72	25	28	67
Wet Pond	72	36	53	56
Vegetated Filter Strip	80	34	53	75

[a] *WSDOT (1999).*

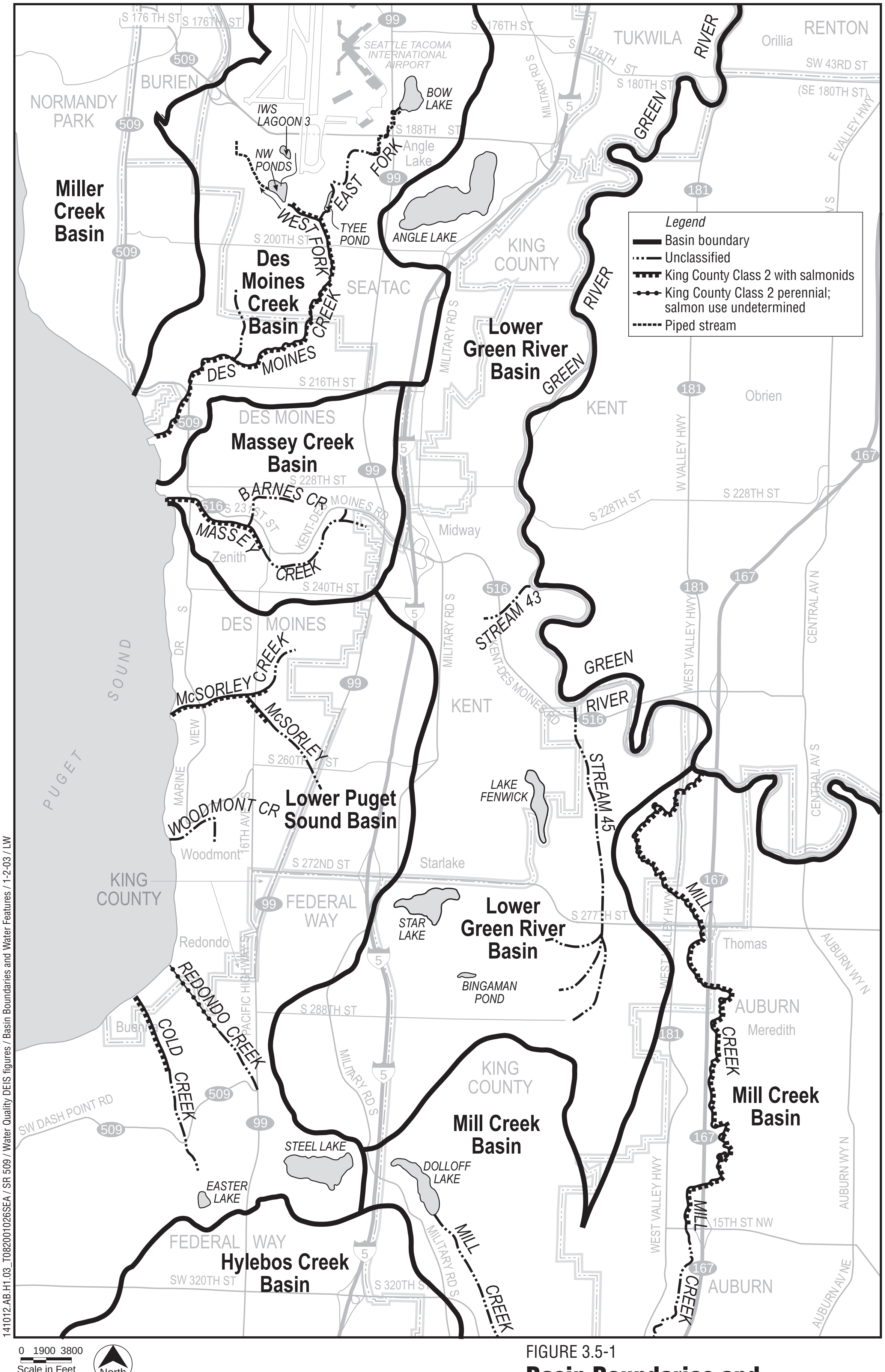

FIGURE 3.5-1

Basin Boundaries and Water Features

SR 509: Corridor Completion/I-5/South Access Road Environmental Impact Statement

141012.AB.H1.03_T08200I026SEA / SR 509 / Water Quality DEIS figures / Basin Boundaries and Water Features / 1-2-03 / LW

Wet ponds, bioswales, wet vaults, stormwater treatment wetlands, and some other innovative technologies, including treatment trains, have been considered for stormwater treatment. A description of technologies and some experimental BMPs being considered were presented in the *Stormwater Treatment Technical Memorandum* (CH2M HILL August 2001b) and the *SR 509/I-5 Stormwater VE* (Olympic Associates Company 2002).

3.5.2 Affected Environment

Basins and Resources

The proposed project would potentially affect the quality of water resources in five basins. These water resources include rivers, creeks, lakes, wetlands, and groundwater.

Miller Creek Basin

Miller Creek Basin includes a drainage area of 5,200 acres and drains into Puget Sound. The Washington State Department of Fish and Wildlife (WDFW) identifies Miller Creek as stream 09.0371. The basin would be affected to an equal extent by each of the build alternatives; however, only a relatively small area of the basin would be disturbed, and there would likely be no substantial water quality impacts.

Des Moines Creek Basin

Des Moines Creek Basin includes a drainage area of 3,700 acres. Sea-Tac Airport in the northern portion of the basin occupies approximately 27 percent of the total basin area. The remainder of the basin is largely urbanized. Important resources in the basin include Des Moines Creek (King County 1987) and associated wetlands. Bow Lake, Northwest Ponds (Wetland F), and Tyee Pond currently provide stormwater detention and treatment and are also near the build alternatives. Additional wetlands also are located within the Des Moines Creek Basin. Des Moines Creek, a King County Class 2 stream with salmonids, is the main drainage course in that basin.

Des Moines Creek generally flows south to southwest and empties into Puget Sound near South 222nd Street. WDFW identifies Des Moines Creek as stream 09.0377. Two major tributaries and two minor tributaries flow into Des Moines Creek. The major tributaries are known informally as the East Fork and West Fork. The East Fork, originating from Bow Lake, is a King County Class 3 stream in its lower reaches and unclassified in its upper reaches. Class 3 streams have intermittent flow and are not used by salmonids. The West Fork flows out of the Northwest Ponds complex at the western edge of the Tyee Valley Golf Course. The upper reaches of the West Fork are either designated Class 3 or are unclassified, while the lower reaches are Class 2. The two minor tributaries to Des Moines Creek are both unclassified.

Just upstream of the project area, near the Bow Lake outlet to the East Fork of Des Moines Creek, the corresponding flood frequency exceedance levels are 21, 29, and 35 cubic feet per second (cfs) (Des Moines Creek Basin Committee 1997). In general, impervious surfaces associated with development in the watershed have increased peak flows, resulting in downstream flooding in Des Moines Creek relative to predeveloped conditions. The higher peak flows, in turn, have led to problems with channel erosion and scouring of spawning gravel in downstream reaches of Des Moines Creek. The frequent flooding in the creek has also damaged public buildings and facilities in Des Moines Beach Park (Des Moines Creek Basin Committee 1997).

Lower Green River Basin

The Lower Green River Basin is a large basin that drains to the Duwamish River. Streams designated as 43 and 45 by USFWS drain the basin north to Green River, which drains north to Puget Sound.

Stream 43 flows into the Green River at about river mile (RM) 20.0, and is located about 3,000 feet east of the project area. Stream 45 flows into the Green River at about RM 21.7, and is located more than 1 mile east of the project area. Star Lake is located about 1,000 feet east of the project area, and Lake Fenwick is located more than 1 mile east of the project area.

Lower Puget Sound Basin

Streams in the Lower Puget Sound Basin include McSorley Creek, Woodmont Creek, Redondo Creek, and Cold Creek, all draining to Puget Sound. This basin would be impacted by stormwater runoff from the improvements along the I-5 corridor, located on the eastern boundary of the basin.

McSorley Creek is located within Saltwater State Park and flows into Puget Sound. Woodmont Creek flows directly into Puget Sound. The creek originates in a forested ravine more than 1 mile west of the project area. Woodmont Creek functions primarily as a stormwater conveyance channel with severe bank erosion (King County 1991). Redondo Creek flows directly into Puget Sound. Redondo Creek is located more than 1 mile west of the project area. Redondo Creek is one of the most severely incised channels in the basin, with heavy erosion associated with high flows and poor water quality resulting from nonpoint pollution from residential and commercial sources (King County 1991).

Cold Creek, located more than 1 mile west of the project area, flows into Puget Sound. Cold Creek has been piped and channeled in several locations.

According to the *Lower Puget Sound Basin Plan* (King County 1991), Cold Creek drains from Easter Lake.

Mill Creek Basin

Water resources in the Mill Creek Basin include Mill Creek and Lake Dolloff. This basin would be impacted by stormwater runoff from the improvements along 4,000 feet of the I-5 corridor, located on the eastern boundary of the basin.

Mill Creek flows into the Green River at about RM 24.0. Lake Dolloff is located about 1,000 feet west of the project area. Mill Creek flows to the south from the outlet at the southeast end of Lake Dolloff, about 2,000 feet from the project area. Mill Creek drains first south, then north for about 8.4 miles into the Green River.

Groundwater

The project area has three aquifers, including a shallow aquifer, an intermediate aquifer, and a deep aquifer.

The shallow aquifer is composed of the Vashon Advance Outwash (Esperance Sand). Groundwater occurs under unconfined conditions and is typically protected from direct surface water infiltration by overlying fill or till. The base of the shallow aquifer ranges between elevation 200 and 250, and its thickness varies seasonally, typically between 50 and 75 feet. The water table is approximately 10 to 50 feet below the ground surface. This aquifer has moderate permeability and a maximum well capacity of 500 gallons per minute (gpm).

The intermediate aquifer typically occurs between sea level and elevation 200, with thickness ranging from approximately 50 to 250 feet. Flow in this aquifer is under confined conditions in the west and under unconfined conditions in the east. The aquifer has high permeability and a maximum well capacity of 3,000 gpm.

The deep aquifer is composed of coarse-grained deposits. It is highly confined, generally below elevation (–100), and has saturated thickness below 150 feet. The aquifer has low to moderate permeability and a maximum well capacity of 1,500 gpm (in its most permeable parts).

The shallow aquifer is separated from underlying aquifers with a layer of Lawton clay that has very low permeability. The intermediate aquifer is separated from the deep aquifer with a layer of fine-grained sand and silty sand.

Groundwater generally flows downward from the shallow aquifer to the intermediate and deep aquifers. Laterally, groundwater discharges into the streams of the Green River Watershed to the east, and into the streams of Puget Sound to the west. Groundwater also discharges as underflow to the Green River Valley and Puget Sound, and as pumped water from municipal water supply wells in the Des Moines area.

Groundwater is recharged by infiltrating precipitation across all pervious surfaces in the study area. The magnitude of recharge primarily depends on the permeability of the surface sediments and topography. However, recharge occurs only after evapotranspiration and soil moisture deficits have been satisfied.

The water quality of underlying aquifers was studied as part of the preparation of the EIS for the Seattle-Tacoma International Airport (Federal Aviation Administration and Port of Seattle 1996). Water samples from several wells in the shallow aquifer showed groundwater to be of good water quality. The intermediate aquifer and deep aquifer have excellent water quality based on the studies by the Seattle Water Department (Seattle Water Department, et al. 1990).

The underlying aquifers have been used historically as a source of groundwater for water supply. The shallow aquifer has been used for domestic, irrigation, and/or commercial purposes. The intermediate aquifer and the deep aquifer have been primarily used for municipal water supply. The largest municipal user is the Highline Water District, which draws approximately 1.5 million gallons per day of water from the deep aquifer via the Angle Lake and Des Moines production wells. Highline Water District owns two wells, Tyee Well and Well #2, both of which are on Port of Seattle property. Tyee Well is being developed for municipal use and will replace Well #2, which is now being used for groundwater monitoring. Other suppliers in the area include King County Water Districts 24 and 75.

Non-municipal water wells in the area include a Washington Natural Gas Company well and three private wells that are not used for drinking water. Two of the private wells are located along Des Moines Memorial Drive near South 192nd Street, and the third is located along South 188th Street near 32nd Avenue South (Department of Ecology water well reports, June 2002). Use of these wells is unknown. Two additional wells are located on Port of Seattle property and are owned by the Port: Well 2M, which is used for groundwater monitoring, and Well #1, which is used to irrigate Tyee Valley Golf Course. Well locations are shown in Figures 3.5-2, 3.5-3, and 3.5-4.

Well #1, Well 2M, Tyee Well, Well #2, and two private wells are in the immediate vicinity of the SR 509 corridor. Angle Lake well, Des Moines well, and the Washington Natural Gas well are at least 400 feet from the planned SR 509 roadway or the South Access Road. All other wells are far from the construction of the project.

141012.AB.J1.03_T122002005SEA / SR 509 Final Notebook / / Fig 3.5-2 Alt B and Water Resources / 12-31-02 / LW

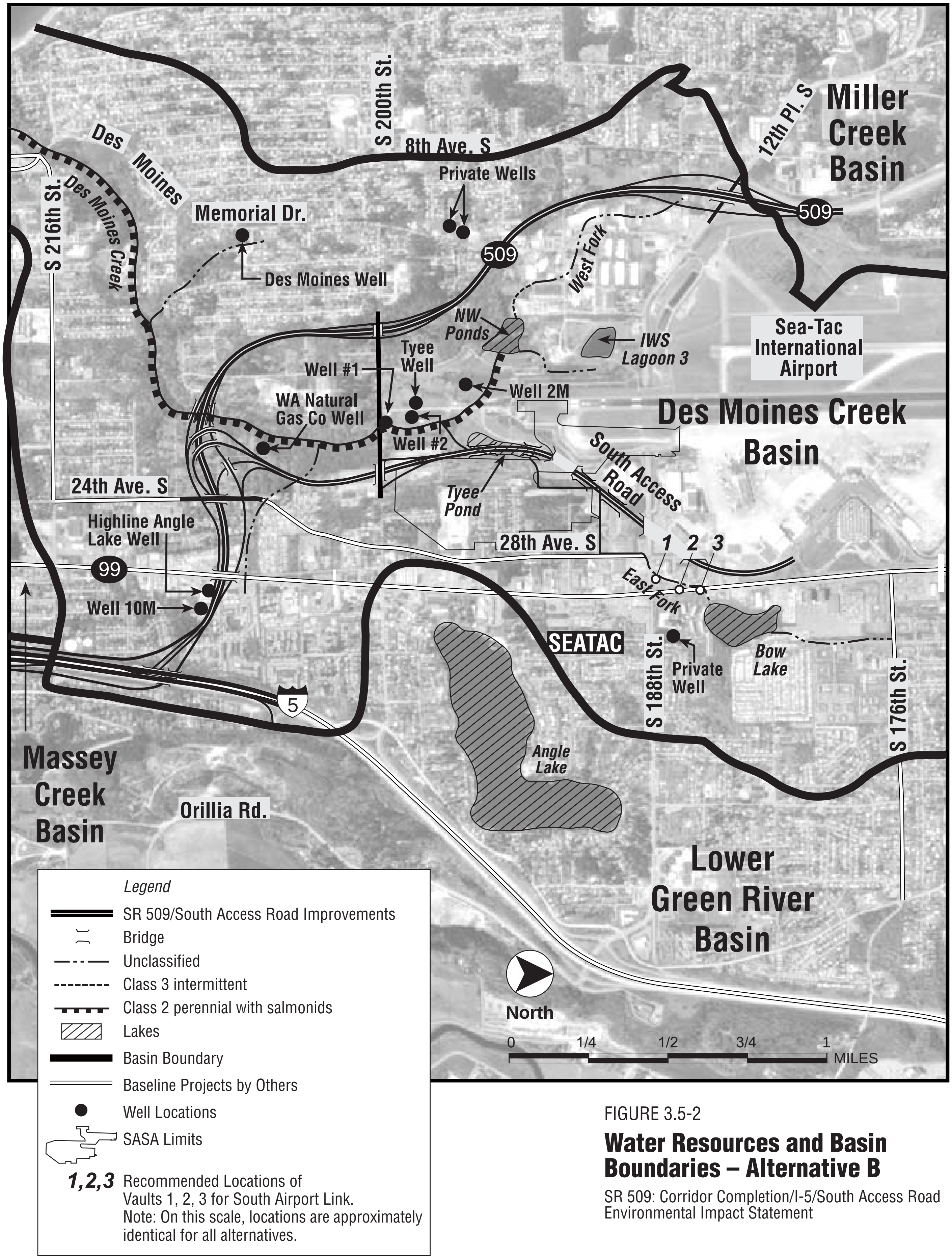

FIGURE 3.5-2

Water Resources and Basin Boundaries – Alternative B

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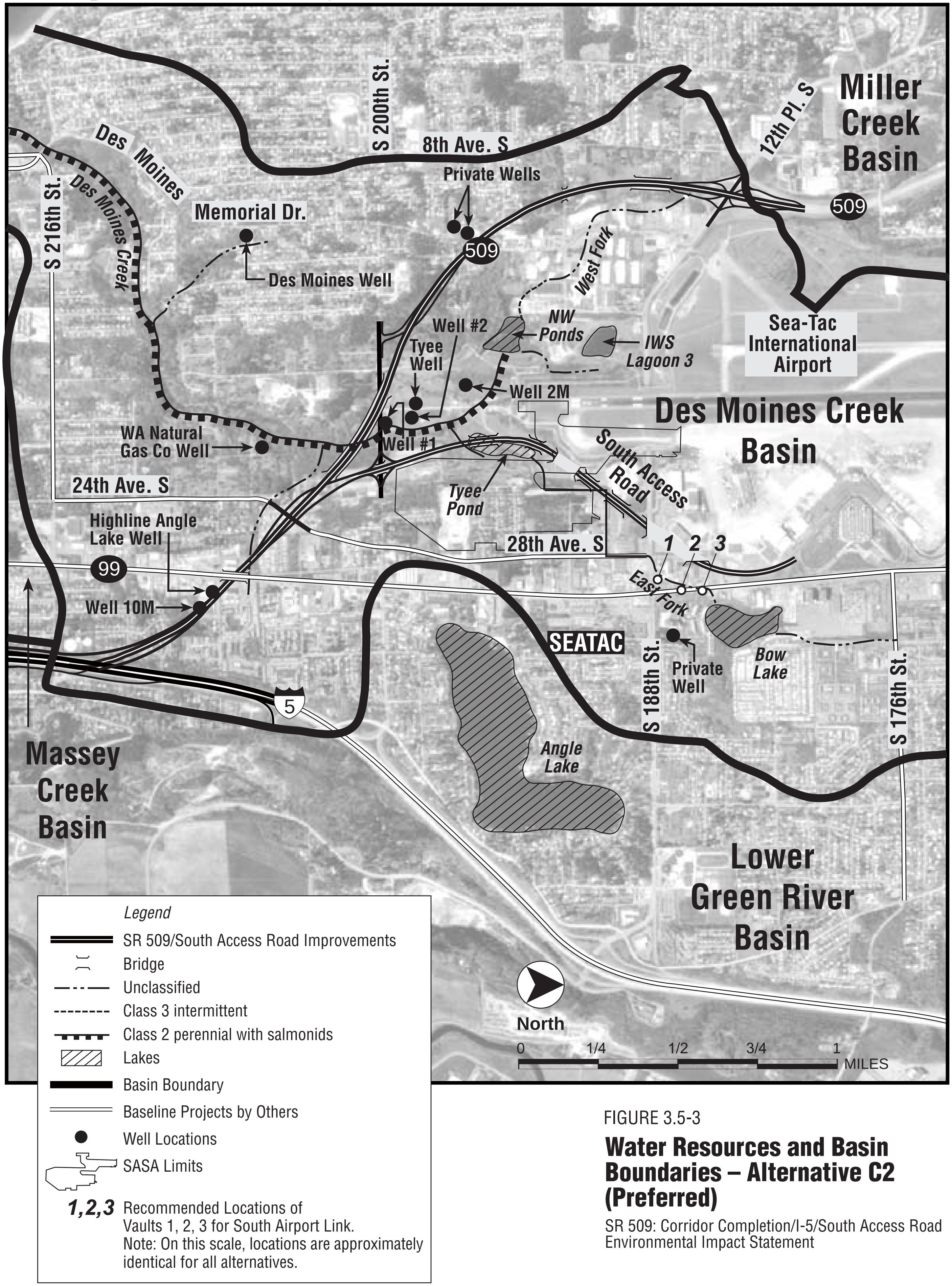

FIGURE 3.5-3

Water Resources and Basin Boundaries – Alternative C2 (Preferred)

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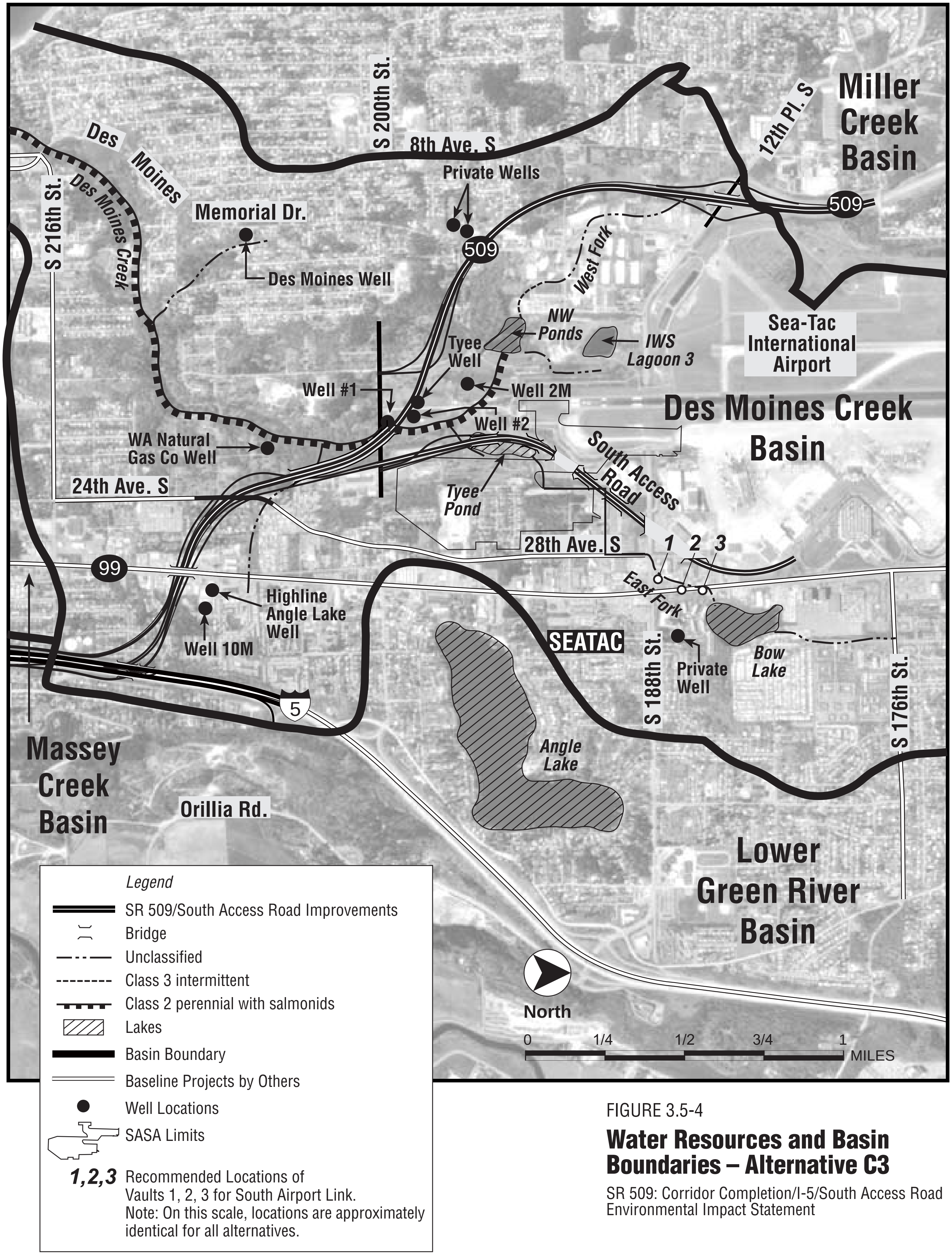

FIGURE 3.5-4

Water Resources and Basin Boundaries – Alternative C3

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Surface Water

Des Moines Creek

Des Moines Creek is classified by the Washington State Department of Ecology as Class AA (extraordinary) (Des Moines Creek Basin Committee 1997). Class AA waters should be usable for water supply, livestock watering, fish and wildlife, and recreation. Water quality standards for Class AA waters are discussed relative to WAC Chapter 173-201A, *Water Quality Standards for Surface Waters of the State of Washington* (Table 3.5-2).

Water quality data collected in recent years indicate that elevated pollutant levels frequently occur in Des Moines Creek. Water quality monitoring conducted as part of the *Five-Year Project Report: City of Des Moines Water Quality Monitoring Program* (Herrera 2001) identified the following water quality concerns: high temperatures and low dissolved oxygen during base flow; high turbidity, total suspended solids, and metals concentrations during storm flows; and high fecal coliform concentrations during storm and base flows.

In response to concerns over increased urbanization within the Des Moines Creek Basin, a multiagency watershed management team represented by Metro, King County, Port of Seattle, Ecology, and Trout Unlimited was established in 1986 to formulate a restoration plan for the creek. The team prepared a watershed management plan to control and maintain water quality and restore and maintain viable populations of salmon and trout. The recommended restoration plan is outlined in the *Des Moines Creek Restoration Project* (Herrera and Hall 1989). In the restoration plan, violations of water quality standards were reported for fecal coliform bacteria, metals, and turbidity.

In addition to water quality concerns associated with urban development, pollutants from operations at Sea-Tac Airport also are a concern (Des Moines Creek Basin Committee 1997). In general, water quality monitoring at the airport has shown runoff from the airport to be comparable to that of runoff from other urban land uses in the basin. However, there are industrial pollutants unique to airport operations that are collected and treated by the airport's Industrial Wastewater System (IWS). The IWS collects and processes drainage from areas in the airport that are more likely to contribute pollutants such as the aircraft servicing, loading, and de-icing locations. Effluent from the IWS is treated and then routed by pipeline along Des Moines Creek to just below the Midway Sewage Treatment Plant, where the IWS line joins the deep sewer outfall, which discharges to Puget Sound. Three fuel spills from the airport into Des Moines Creek between 1973 and 1986 resulted in mortality to fish and aquatic life (Parametrix 1994). Since these accidental spills, modifications to the IWS and inclusion of the Tyee

Pond within the Regional Detention Facility make it unlikely that an impact of this nature would ever be repeated. Tyee Pond was designed to contain hydrocarbon spills and prevent them from reaching Des Moines Creek.

The airport's Storm Drain System (SDS) generally drains the runways, taxiways, and building roofs. Because these areas contribute relatively small pollutant loads, stormwater from the SDS discharges directly to Des Moines Creek in several locations along the perimeter of the airport. Monitoring

Table 3.5-2
Washington State Department of Ecology Water Quality Standards for Class AA Freshwaters and Lake Class

Parameter	Water Type	Standard[a]
Fecal coliform bacteria	Freshwater/ Lake	Shall not exceed a geometric mean of 50 colonies per 100 mL, and no more than 10% of samples used in calculating the geometric mean shall exceed 100 colonies per 100 mL.
Dissolved oxygen	Freshwater	Shall exceed 9.5 mg/L.
	Lake	No measurable decrease from natural conditions.
Total dissolved gas	Freshwater/ Lake	Shall not exceed 100% of saturation at any point of sample collection.
Temperature	Freshwater	Shall not exceed 16°C due to human activities. Incremental increases resulting from nonpoint source activities shall not exceed 2.8°C.
pH	Freshwater	Shall be in the range 6.5 to 8.5, with the human-caused variation within a range of less than 0.2 units.
	Lake	No measurable change from natural conditions.
Turbidity	Freshwater	Shall not exceed 5 NTU over background conditions when the background is 50 NTU or less, or have more than 10% increase in turbidity when background is more than 50 NTU.
	Lake	Shall not exceed 5 NTU over background conditions.
Toxic, radioactive, or deleterious material concentrations	Freshwater	Shall be below concentrations that may adversely affect characteristic water uses, cause acute or chronic conditions in the most sensitive aquatic biota, or adversely affect public health.

[a] Adapted from Water Quality Standards for Surface Waters of the State of Washington, WAC Chapter 173-201A, November 18, 1997. See this statute for complete language on water quality standards for these parameters and acute and chronic standard for toxic substances (e.g., metals, pesticides, and organics), which are not listed here.
mL = milliliter
mg/L = milligrams per liter
°C = degree(s) Celsius
% = percent
NTU = nephelometric turbidity units

conducted by the Port of Seattle indicates that stormwater from the airport is generally cleaner compared to similar urban runoff for TSS, biological oxygen demand (BOD), TP, total copper, total lead, total zinc, and oil and grease (Port of Seattle November 1996, June 1997, September 1997, November 1998). Chemicals associated with de-icing activities have also been detected in stormwater samples from the airport (Des Moines Creek Basin Committee 1997). For example, ammonia (from urea) in airport stormwater has been detected at concentrations that violate both chronic and acute toxicity standards for aquatic life (Port of Seattle April 1996). However, because urea is no longer used as a de-icer at the airport, observed ammonia levels have been generally lower compared to other urban land uses (Port of Seattle 1999). Both the airport's IWS and SDS facilities are covered by an NPDES permit issued by Ecology. This permit regulates the discharges from both systems and is periodically reviewed and updated.

In 1997, the *Des Moines Creek Basin Plan* (Des Moines Creek Basin Committee 1997) was produced through a cooperative interjurisdictional effort undertaken by King County, the Cities of SeaTac and Des Moines, and the Port of Seattle. One of the primary goals of this basin plan was to develop a shared plan for addressing water quality and quantity issues. The specific water quality-related concerns that were identified in the *Des Moines Creek Basin Plan* are: Turbidity and suspended solids; high nutrient levels; water temperatures that frequently exceed optimal upper temperature limits for salmonid species; and low dissolved oxygen.

Average seasonal flow rates near the outlet of Des Moines Creek range from 1.3 cfs in July to 12.3 cfs in December. At the outlet of Des Moines Creek, flow levels for events with 2-, 5-, and 10-year recurrence intervals are estimated to be 171, 211, and 255 cfs, respectively. In general, impervious surfaces associated with development in the watershed have increased peak flows and downstream flooding in Des Moines Creek relative to predeveloped conditions. The higher peak flows have, in turn, led to problems with channel erosion and scouring of spawning gravel in downstream reaches of Des Moines Creek. The frequent flooding in the creek has also damaged public buildings and facilities in Des Moines Beach Park.

Lower Green River

The Lower Green River has been listed as a Class AA (extraordinary) freshwater creek (WAC 173-201A 1997). Class AA waters generally exceed the water quality requirements for all beneficial uses. The Lower Green River watershed is part of the Green River/Duwamish River watershed, and is located east of I-5 and the Sea-Tac Airport, including Angle Lake. United States Geological Survey (USGS), Ecology, and Metro have measured water quality at several locations on this watershed during the last decade. The focus of these studies was nutrients from precipitation and domestically applied fertilizers. Precipitation is estimated to contribute from 1 to 2 tons of nitrogen per square mile each year, and from 0.10 to 0.2 ton of phosphorus per square mile of the watershed each year (USGS 1995). Additionally, these studies estimated annual contribution of 1 ton per square mile per year of inorganic nitrogen. No additional water quality data have been collected for this project.

Streams of Lower Puget Sound Basin

No water quality data are available for Woodmont Creek. Redondo Creek and Cold Creek have been monitored by King County (1991). However, water quality standards in those creeks have not been exceeded since 1998 (Ecology 1998).

Water quality monitoring of McSorley Creek was conducted by Parametrix (1988-89), King County (1990), and Herrera (2001). King County and Parametrix showed that the North Fork of McSorley Creek receives stormwater runoff from the Midway landfill. The monitoring showed that concentration of fecal coliforms, dissolved oxygen, and phosphorus all exceeded recommended WAC standards. During the five-year monitoring period (1995-1999), Herrera confirmed that both stormwater and base-flow samples exceeded the WAC standards for temperature and dissolved oxygen. Storm-flow ammonia nitrogen concentrations in the downstream reaches were also 50 percent higher than the median level at the other King County streams. Concentrations of dissolved copper, total copper, and dissolved lead all often exceeded the WAC standards during both base flow and stormwater events. The fecal coliform bacteria concentrations were particularly high in Lower McSorley Creek.

Mill Creek

King County and Ecology conducted water quality monitoring on the creek during 1993 and 1994. Water temperatures exceeded the Washington State standards upper temperature limits several times. Fecal coliform bacteria similarly exceeded the Washington State standards upper limits numerous times.

Clean Water Act Section 303(d) Waters

According to Ecology's Section 303(d) list (1998), Des Moines Creek, Mill Creek, and some reaches of the Green River do not meet Washington State water quality standards for selected parameters.

Des Moines Creek is listed as a 303(d) water because of high fecal coliform bacteria concentrations. Temperature and dissolved oxygen in the creek were also measured above the standards during one monitoring event. Green River is listed as a 303(d) water because of exceedances for mercury, fecal coliforms, chromium, and temperature. Mill Creek is listed as a 303(d) water because of exceedances for temperature, dissolved oxygen, and fecal coliforms.

3.5.3 Environmental Impacts

Alternative A (No Action)

Under the No Action Alternative, adverse effects on water quality from the proposed project would not occur. However, other roadway construction and developments are planned and anticipated to occur over the next few years in the project vicinity. These activities would add impervious surfaces to the basins in the project area that could adversely affect the water quality of streams and wetlands.

Under the No Action Alternative, WSDOT would not contribute funds to the Capital Improvement Projects (CIPs) in the Des Moines Creek Basin Plan, which would make financing of these projects more difficult and could result in delays to these projects.

Impacts Common to All Build Alternatives

Surface Water

Each of the build alternatives would result in vegetation removal, regrading of the existing ground surfaces, and creation of new impervious surfaces. Removing vegetation would decrease stormwater infiltration into the soil profile, expose mineral soils, and decrease evapotranspiration. Removing vegetation adjacent to streams could reduce shading and increase the temperature of water in the streams. Regrading the ground surface along the alternative alignments would disrupt upstream surface waters, including sheet flow and channelized flow. Sheet flow that currently flows across the project area from land upstream and adjacent to the roadway would be intercepted, conveyed, and discharged to a collection system.

Stormwater runoff from the highway, accidental spills, sanding and de-icing, and vegetation controls are operational activities that have the potential to affect surface water. The maintenance of road and drainage structures would potentially impact surface water. The operational impacts are described below.

Water Quantity

New impervious highway surfaces and reduced soil infiltration capacity resulting from grading and landscaping in the remaining portion of the right-of-way would increase surface water runoff rates and volumes. The increase in surface water flow rates and volumes could cause erosion and subsequent sedimentation in receiving channels. Stormwater from the highway would be collected and conveyed to management facilities to attenuate peak flow rates.

If the proposed project is approved and funded, WSDOT would contribute to CIPs identified in the Des Moines Creek Basin Plan. The stormwater facility design for the SR 509 project within Des Moines Creek basin would assume the construction of three CIPs: the expansion of the Northwest Ponds as a regional detention facility; a high-flow bypass pipe; and replacement of a culvert under Marine View Drive with a bridge. These three projects would reduce peak flows in Des Moines Creek to approximately 1940 levels. In all affected basins, the proposed project would collect stormwater runoff for every storm less than the 6-month storm event.

With implementation of the three CIPs, the SR 509 project stormwater facilities would be designed to King County Level I flow criteria (*King County Surface Water Design Manual* 1998) using 1994 development levels for the existing runoff model. When this design criterion is applied along with the basin plan projects, peak flows in the basin for the 2-, 10-, 50-, and 100-year events would be reduced in comparison to existing conditions. Because stormwater releases to Des Moines Creek would be significantly reduced, no increase in erosion potential to the stream banks is anticipated as a result of the project.

Stormwater facilities in the Green River, Lower Puget Sound, Mill Creek. and Miller Creek Basins would meet King County Level II or III flow control criteria (King County 1998) as dictated by the local jurisdictions and based on assessments of a stream's or basin's susceptibility to high flows. King County Level II criteria would require the project to match the duration of flows between 50 percent of the 2- and 50-year storm events to the predeveloped condition and would also require reducing the duration of these flows to 50 percent of existing conditions. Level II would be applied to the Green River, Lower Puget Sound and Miller Creek Basins. In the more sensitive Lower Puget Sound Basin, flows would be released on the basis of the King County Level III criteria; this meets Level II standards and additionally requires matching peak flows for a 100-year storm event.

Nevertheless, total runoff volumes would most likely be higher compared with existing conditions, and the duration of flow for a given storm volume would be shorter.

Water Quality

Operation and maintenance of the build alternatives could degrade the quality of surface waters unless stormwater is effectively treated. Pollutants such as oil and grease, zinc, copper, wear from tires, vehicle particle flake, and sediments are commonly associated with highway stormwater runoff. The relative impact of a particular activity would depend to a large extent on its proximity to the receiving water bodies and the susceptibility of the water to the delivered pollutant. Specifically, Alternatives B, C2, and C3 would affect Des Moines Creek at one crossing of the main stem of Des Moines Creek, and four crossings of the East Fork of Des Moines Creek. No streams would be crossed by the I-5 improvements.

Using the FHWA procedure (FHWA April 1990a, April 1990b), the probabilities of exceeding ambient background concentrations and Washington State Class A standards prior to any water quality treatment were estimated for each of the build alternatives. Stormwater pollutant concentrations for all pollutants would exceed the 0.35 percent threshold, below which no stormwater treatment is required. Statistically, there would be no difference among the build alternatives. The slight differences in concentrations would be due to different tributary watershed sizes and percentage of impervious surfaces on each watershed.

Water quality protection would be provided through water quality treatment facilities. Proposed treatment BMPs for the proposed project would include infiltration ponds, infiltration vaults, detention ponds, bioswales, filter strips, and constructed wetlands. Where subsurface conditions allow, stormwater would be treated, then infiltrated. Where infiltration would not be feasible, stormwater would be detained and would receive enhanced treatment for metals, such as filter strips and constructed wetlands.

Clean Water Act Section 303(d) Waters

The 303(d) listing cites Des Moines Creek for high fecal coliforms; the Green River for heavy metals and temperature; and Mill Creek for temperature, dissolved oxygen, and fecal coliforms. Water temperature is not expected to inadvertently increase because trees and shrubs would be planted around treatment facilities in the Des Moines Creek and Mill Creek Basins and along the banks of Des Moines Creek. Additional design features would be incorporated into stormwater facility outfalls to replenish oxygen levels. Fecal coliform bacteria are usually not generated by highway runoff and therefore would not contribute fecal coliforms to project area streams.

Heavy metals typically appear in the creeks during first fall flush storms. However, the enhanced treatment provided by the proposed stormwater treatment facilities would prevent most metals from entering the streams. Storms with a return period higher than 6 months could be released into the creeks and could bypass some facilities. However, during these infrequent storm events, pollutants of concern for 303(d) listing would be diluted in runoff from these storms and are not expected to present significant water quality issues.

Groundwater

Infiltrated stormwater pollutants from new impervious surfaces could cause potential adverse impacts on groundwater quality. Well 1, Well 2M, and Tyee well are the only municipal wells close to the future alignment of SR 509. Two private wells are located close to the alignment where it crosses Des Moines Memorial Drive. These two private wells are not used for drinking water. During construction of the SR 509 roadway, WSDOT would work with the Highline Water District to ensure no contamination of the existing water supply. WSDOT would likely decommission one or both of the private wells that are located in proposed new right-of-way. Construction BMPs and water quality monitoring and reporting of the stormwater runoff from the construction site would be implemented.

Groundwater recharge from the surface would be reduced in areas where fill would be placed and compacted. Recharge could be increased in areas where till would be removed to expose Esperance Sand.

Accidental Spills

The volume of hazardous materials (such as petroleum products) that would be transported through and delivered within the project area is determined predominantly by the local demand for such materials. Each of the build alternatives would provide a transportation corridor designed under current regulatory safety standards, which would result in a lower frequency of accidents compared with existing roads designed to earlier standards. Thus, the risk of accident-related spills would be expected to be lower under any of the build alternatives compared to the No Action Alternative because the new roadway would improve the overall safety of the road system.

The Tyee wetland/stormwater pond was designed to control stormwater flow and allow temporary shut down of flow to Des Moines Creek in the event of a pollutant spill further upstream. Where the pond could not be avoided, each of the build alternatives would span the pond with a bridge. Because no fill or bridge supports would be placed within the pond, there would be no reduction in pond storage volume, and, therefore, no effect on its stormwater control function.

Vegetation Management

Vegetation would be managed through implementation of Integrated Vegetation Management (IVM) within WSDOT's *Roadside Classification Plan* (RCP) (WSDOT 1996). The IVM promotes use of native vegetation, implementation of the visual quality policy, and reduced use of fertilizers, pesticides, and other chemical controls. The visual quality policy promotes environmentally beneficial landscaping, including use of water-efficient and runoff-reduction practices and construction with minimum impact on habitat. However, even with the most conservative use, some amounts of landscaping chemicals or herbicides would be expected to enter the receiving surface water bodies during storm events.

Alternative B

Under Alternative B, the SR 509 freeway extension and South Access Road (Figure 3.5-2) would create 89.5 acres of new impervious surface in Des Moines Creek and Miller Creek Basins. Total new impervious surface area for Alternative B, including the I-5 improvements, would be 126.5 acres. The SR 509 alignment of Alternative B would necessitate one stream channel crossing over a Class 2 reach of Des Moines Creek near the intersection of South 208th Street and 18th Avenue South. The alignment of the South Access Road would cross the channelized and piped upper reaches of the East Fork tributary to Des Moines Creek at four locations, which are either Class 3 or unclassified.

SR 509 Freeway Extension/South Access Road

The SR 509 freeway extension/South Access Road portion of the project is located in the Des Moines Creek and Miller Creek basins. Using WSDOT BMP effectiveness rates (Table 3.5-1), final pollutant concentrations after treatment at various BMPs were estimated and are presented in Table 3.5-3. The thresholds recommended by the EPA, along with the Washington State Class A threshold for zinc, are also included for comparison. The estimated concentrations represent typical concentrations of pollutants after passing through the proposed water quality treatment facilities and before entering natural soil or being discharged to receiving waters. Where infiltrated, pollutant concentrations would be further reduced as they pass through the soil.

The average annual pollutant loadings from new roadway surfaces were computed for TSS, zinc, TKN, and TP using the FHWA procedure (FHWA 1996). For comparison purposes, the obtained annual loadings were then reduced assuming treatment efficiencies for biofiltration swales and wet ponds (Table 3.5-1) for each of the proposed alternatives. These estimated loadings, before and after treatment, are presented in Table 3.5-4.

Annual mass loading would be the highest of the build alternatives for each pollutant evaluated. Assuming biofiltration and wet pond stormwater treatment, annual TSS loading would range from nearly 4,300 kg (Des Moines Creek Basin) to 337 kg (Miller Creek Basin) (Table 3.5-4).

Proposed treatment BMPs for the SR 509 freeway extension and South Access Road would include infiltration ponds, infiltration vaults, detention ponds, bioswales, filter strips, and constructed wetlands (See Section 3.5.4, Mitigation Measures).

Table 3.5-3
Pollutant Removal Using Various BMPs for Selected Parameters

Basin/Parameter	Site Median Concentration (mg/L)[b]	Background Concentration (mg/L)[c]	EPA Acute Criteria (mg/L)[d]	WA State Standard (stormflow; baseflow) (mg/L)[e]	Concentration After BMP Treatment (mg/L)[a]				Biofiltration Swale and Wet Pond Train (mg/L)
					Wet Vault	Biofiltration Swale	Wet Pond	Vegetated Filter Strip	
Des Moines Creek Basin									
Total Suspended Solids	142.00	58.70			109.34	39.76	39.76	28.40	11.13
Zinc	0.33	0.02	0.18	0.064; 0.095	0.31	0.11	0.14	0.08	0.05
Total Phosphorus	0.40	0.15			0.38	0.29	0.19	0.19	0.14
Total Kjeldahl Nitrogen	1.83	---			1.74	1.37	1.17	1.21	0.88
Miller Creek Basin									
Total Suspended Solids	142.00	60.00			109.34	39.76	39.76	28.40	11.13
Zinc	0.33	0.02	0.18	0.064; 0.095	0.31	0.11	0.14	0.08	0.05
Total Phosphorus	0.40	0.15			0.38	0.29	0.19	0.19	0.14
Total Kjeldahl Nitrogen	1.83	---			1.74	1.37	1.17	1.21	0.88
Lower Green River Basin									
Total Suspended Solids	142.00	7.9			109.34	39.76	39.76	28.40	11.13
Zinc	0.33	0.023	0.18	0.064; 0.095	0.31	0.11	0.14	0.08	0.05
Total Phosphorus	0.40	0.031			0.38	0.29	0.19	0.19	0.14
Total Kjeldahl Nitrogen	1.83	---			1.74	1.37	1.17	1.21	0.88
Lower Puget Sound Basin									
Total Suspended Solids	142.00	12.0			109.34	39.76	39.76	28.40	11.13
Zinc	0.33	0.023	0.18	0.064; 0.095	0.31	0.11	0.14	0.08	0.05
Total Phosphorus	0.40	0.141			0.38	0.29	0.19	0.19	0.14
Total Kjeldahl Nitrogen	1.83	---			1.74	1.37	1.17	1.21	0.88
Mill Creek Basin									
Total Suspended Solids	142.00	12.0			109.34	39.76	39.76	28.40	11.13
Zinc	0.33	0.023	0.18	0.064; 0.095	0.31	0.11	0.14	0.08	0.05
Total Phosphorus	0.40	0.141			0.38	0.29	0.19	0.19	0.14
Total Kjeldahl Nitrogen	1.83	---			1.74	1.37	1.17	1.21	0.88

[a] *See Table 3.5-1 for BMP treatment efficiencies.*
[b] *FHWA (1996). Site median concentration values are the median site values from the FHWA database (993 runoff events) for urban highways with average annual daily traffic >30,000 vehicles/day.*
[c] *Stream background concentrations for the Miller Creek and Green River Basins (for all pollutants except zinc and copper) were estimated as arithmetic averages from samples in the Des Moines Creek and Massey Creek Basins. Stream concentrations for the Lower Puget Sound and Mill Creek Basins were estimated as arithmetic averages form samples in the Mill Creek Basin. Stream concentrations for the Lower Green River Basin were estimated from the water quality samples from the Green River in Kent at 212th Street.*
[d] *National Urban Runoff Program (NURP) conducted by EPA.*
[e] *Source: WAC Chapter 173-201A (storm flow hardness = 50 ppm, base flow hardness = 80 ppm).*

Table 3.5-4
Total Pollutant Loading From New Roadway Surfaces from SR 509/South Access Road Alternatives (kg/year)

Pollutant	Alternative	Annual Mass Loading Before Treatment		Annual Mass Loading After Treatment at Bioswale and Wet Pond	
		Des Moines Creek	Miller Creek	Des Moines Creek	Miller Creek
Total Suspended Solids	Alternative B	55,937	4,295	4,385	337
	Alternative C2	41,518	1,267	3,255	99
	Alternative C3	43,808	1,297	3,435	102
Zinc	Alternative B	130	9.5	19	1.4
	Alternative C2	96	2.8	14	0.4
	Alternative C3	101	2.9	15	0.4
Total Kjeldahl Nitrogen	Alternative B	721	52.6	346	25.2
	Alternative C2	535	15.5	257	7.4
	Alternative C3	565	16.9	271	8.1
Total Phosphorus	Alternative B	130	9.5	44	3.2
	Alternative C2	96	2.8	32	0.9
	Alternative C3	101	2.9	34	1.0

Note: Annual mass loadings for each alternative were computed using the FHWA procedure (FHWA, 1996). Pollutant loadings were then reduced assuming treatment efficiencies from Table 3.5-1.

I-5 Improvements

The proposed I-5 improvements would create approximately 37 acres of new impervious surface. Approximately 1.3 acres would be located in the Mill Creek Basin, 10.3 acres in the McSorley Creek Subbasin of the Lower Puget Sound Basin, 23.3 acres in the Lower Green River Basin, and 2.1 acres in the Des Moines Creek Basin. Runoff from the new impervious surfaces has the potential to adversely affect water quality; however, no streams would be crossed by the proposed I-5 improvements.

Using WSDOT BMP effectiveness rates (Table 3.5-1), final pollutant concentrations after treatment at various BMPs were estimated for each of the affected basins and are presented in Table 3.5-3. The thresholds recommended by the EPA, along with the Washington State Class A threshold for zinc, are also included for comparison.

The average annual pollutant loadings from new roadway surfaces were computed for TSS, zinc, TKN, and TP using the FHWA procedure (FHWA 1996). The obtained annual loadings were then reduced assuming treatment efficiencies for biofiltration swales and wet ponds (Table 3.5-1). These estimated loadings, before and after treatment, are presented in Table 3.5-5. The highest removal efficiency would be achieved in the Des Moines Creek and Mill Creek basins for all pollutants. The removal of TSS pollutants would be the most efficient (56 to 72 percent). The removal of TKN pollutants would be the least efficient (24 to 36 percent), especially in the Lower Green River Basin (24 percent).

Proposed stormwater treatment for the I-5 improvements would primarily be detention and treatment by stormwater treatment wetlands (See Section 3.5.4, Mitigation Measures).

South Airport Link

This 1,000-foot segment of the proposed South Access Road would impact only the East Fork of Des Moines Creek. For design options H0, H2-A, and H2-B (the preferred option), bioswales in combination with wet vaults are proposed for stormwater treatment.

Pollutant concentrations after treatment at several BMPs, including biofiltration swales and wet vaults as shown in the preliminary stormwater treatment for the South Airport Link, were included for comparison (Table 3.5-6). The results show that use of vegetated filter strips could improve treatment efficiencies. The results for annual pollutant loading for the three South Airport Link design options, after treatment at bioswales followed by wet vaults, are presented in Table 3.5-7. TSS and zinc loading would be reduced 3 to 4 times after treatment, while TP and TKN would be reduced only 1 to 2 times.

Table 3.5-5
Total Pollutant Loading from New Roadway Surfaces for I-5 improvements

Pollutant	Basin Impacted by I-5	Annual Mass Loading Before Treatment (kg/year)	Annual Mass Loading After Treatment (kg/year)	Overall Efficiency (%)
TSS	Des Moines	4,342	1,216	72
	Lower Green River	54,632	24,010	56
	Lower Puget Sound	25,585	9,320	64
	Mill Creek	4,284	1,199	72
Zinc	Des Moines	10	4	56
	Lower Green River	127	74	42
	Lower Puget Sound	59	30	50
	Mill Creek	10	4	59
TKN	Des Moines	56	36	36
	Lower Green River	704	538	24
	Lower Puget Sound	330	237	28
	Mill Creek	55	37	33
TP	Des Moines	12	6	53
	Lower Green River	154	105	32
	Lower Puget Sound	72	44	39
	Mill Creek	12	7	46

Note: Annual mass loadings for each alternative were computed using the FHWA procedure (FHWA, 1996). Pollutant loadings were then reduced assuming efficiency of treatment facilities from Table 3.5-1. No treatment was applied for the pollutant loading for the existing conditions.

Table 3.5-6
Pollutant Removal Using Various BMPs for Selected Parameters for South Airport Link Design Options

Option/Parameter	Site Median Concentration (mg/L)[b]	Background Concentration (mg/L)[c]	EPA Acute Criteria (mg/L)[d]	WA State Standard (stormflow; baseflow) (mg/L)[e]	Concentration After BMP Treatment (mg/L)[a]			
					Biofiltration Swale	Biofiltration Swale and Wet Vault	Wet Pond	Vegetated Filter Strip
Option H0, H2A, H2B								
Total Suspended Solids	142.000	58.700	--	--	39.76	30.62	39.76	28.40
Zinc	0.329	0.023	0.18	0.064; 0.095	0.11	0.10	0.14	0.08
Total Phosphorus	0.400	0.151	--	--	0.29	0.27	0.19	0.19
Total Kjeldahl Nitrogen	1.830	--	--	--	1.37	1.30	1.17	1.21

[a] See Table 3.5-1 for BMP treatment efficiencies. The analysis is limited only to the parameters defined in Table 3.5-1.
[b] FHWA (1996). Site median concentration values are the median site values from the FHWA database (993 runoff events) for urban highways with average annual daily traffic >30,000 vehicles/day.
[c] Background concentrations are based on the average of 15 stormwater samples collected from 2 locations in Des Moines Creek. (Herrera & Hall 1997).
[d] FHWA (April 1990a).
[e] WAC 173-201A (stormflow hardness = 50 ppm, baseflow hardness = 80 ppm).
-- = No criteria/rules available.

Table 3.5-7
Total Pollutant Loading From New Roadway Surfaces for South Airport Link Design Options

Pollutant	Option	Annual Mass Loading Under Existing Conditions (kg/year)	Annual Mass Loading After Wet Vault and Bioswale (kg/year)
Total Suspended Solids	Option H0	3,626	778
	Option H2-A	4,599	1,007
	Option H2-B	5,002	1,135
Zinc	Option H0	8	3
	Option H2-A	11	3
	Option H2-B	12	4
Total Kjeldahl Nitrogen	Option H0	47	33
	Option H2-A	59	43
	Option H2-B	64	48
Total Phosphorus	Option H0	8	6
	Option H2-A	11	7
	Option H2-B	12	8

Note: Annual mass loadings were computed using the FHWA procedure (FHWA 1996). Pollutant loadings were then reduced assuming treatment efficiency from Table 3.5-1. No treatment was applied for pollutant loading for existing conditions.

Alternative C2 (Preferred)

Under Alternative C2 (Figure 3.5-3), the proposed SR 509 freeway extension and South Access Road would create 76 acres of new impervious surface in Des Moines Creek and Miller Creek Basins. Total new impervious surface area for Alternative C2, including the I-5 improvements, would be 113 acres. Water quality impacts from construction and operation would be the highest in areas where the roadway alignment would cross Des Moines Creek and at three crossings of the East Fork of Des Moines Creek.

SR 509 Freeway Extension/South Access Road

As was done for Alternative B, pollutant concentrations after treatment at various BMPs were estimated and are presented in Table 3.5-3. Average annual pollutant loadings from new roadway surfaces were computed for TSS, zinc, TKN, and TP using the FHWA procedure (FHWA 1996). For comparison purposes, the obtained annual loadings were then reduced assuming treatment efficiencies for biofiltration swales and wet ponds. These estimated loadings, before and after treatment, are presented in Table 3.5-4.

Pollutant loadings in both the Des Moines Creek and Miller Creek Basins would be lowest of the build alternatives for each pollutant evaluated. Assuming biofiltration and wet pond stormwater treatment, annual TSS loading would range from 3,255 kg (Des Moines Creek Basin) to 99 kg (Miller Creek Basin), which would be 36 percent lower than in Alternative B and 6 percent lower than in Alternative C3 (Table 3.5-4).

Proposed treatment BMPs for the SR 509 freeway extension and South Access Road would include infiltration ponds, infiltration vaults, detention ponds, bioswales, filter strips, and constructed wetlands (See Section 3.5.4, Mitigation Measures).

I-5 Improvements and South Airport Link

Potential impacts associated with the proposed South Airport Link design options and I-5 improvements would be the same as described for Alternative B.

Alternative C3

Under Alternative C3 (Figure 3.5-4), the proposed SR 509 freeway extension and South Access Road would create 76.5 acres of new impervious surface in Des Moines Creek and Miller Creek Basins. Total new impervious surface area for Alternative C3, including the I-5 improvements, would be 113.5 acres. Potential water quality impacts from construction and operation would be the highest in areas where the roadway alignment would cross Des Moines Creek and the East Fork of Des Moines Creek. The number and locations of stream crossings would be the same as Alternative C2.

SR 509 Freeway Extension/South Access Road

As was done for Alternatives B and C2, pollutant concentrations after treatment at various BMPs were estimated and are presented in Table 3.5-3. Average annual pollutant loadings from new roadway surfaces were computed for TSS, zinc, TKN, and TP using the FHWA procedure (FHWA 1996). For comparison purposes, the obtained annual loadings were then reduced assuming treatment efficiencies for biofiltration swales and wet ponds. These estimated loadings, before and after treatment, are presented in Table 3.5-4.

Pollutant loadings in both Des Moines Creek and Miller Creek Basins would be higher than in Alternative C2, but lower than in Alternative B, for each pollutant evaluated. Assuming biofiltration and wet pond stormwater treatment, annual TSS loadings would range from 3,435 kg (Des Moines Creek Basin) to 102 kg (Miller Creek Basin) (Table 3.5-9), which would be 24 percent lower than in Alternative B.

Proposed treatment BMPs for the SR 509 freeway extension and South Access Road would include infiltration ponds, infiltration vaults, detention ponds, bioswales, filter strips, and constructed wetlands (See Section 3.5.4, Mitigation Measures).

I-5 Improvements and South Airport Link

Potential impacts associated with the proposed South Airport Link design options and I-5 improvements would be the same as described for Alternative B.

3.5.4 Mitigation Measures

Project Design Mitigation Measures

Mitigation has been incorporated into the design of the build alternatives to reduce potential water quality impacts. The project stormwater treatment would be designed in accordance with King County's detention and water quality treatment criteria according to the basic water quality menu in the *Surface Water Design Manual* (King County 1998), the WSDOT 1995 *Highway Runoff Manual* (WSDOT 1995), and additional WSDOT guidance. In addition, to increase the effectiveness of onsite surface water management, stormwater from the roadways would be managed separately from upstream surface water intercepted by the highway in most cases. Whenever possible, the build alternative alignments have been selected to avoid or reduce impacts on sensitive resource areas.

WSDOT would maintain stormwater management facilities for the proposed project, except for facilities at the South Access Road, which would be maintained by the Port of Seattle. WSDOT’s maintenance measures would follow RCP (WSDOT 1996) and the *Regional Road Maintenance Endangered Species Act Program Guidelines* (NMFS 2001). The IVM would promote use of native vegetation and reduced use of fertilizers, pesticides, and other controls. The visual quality policy would assume environmentally beneficial landscaping, use of water-efficient and runoff-reduction practices, and construction with minimal impact on habitat. Regional facilities constructed as part of the Des Moines Creek Basin Plan would not be maintained by WSDOT.

In May 2002, WSDOT conducted a stormwater VE study for the proposed project. The focus of the study was to develop a more detailed and comprehensive stormwater treatment strategy for the project. Although the study was based on the design for Alternative C2, the preferred alternative, the resultant stormwater strategy is applicable to each of the build alternatives.

Opportunities to address stormwater issues using a watershed approach have been incorporated in the stormwater treatment strategy for the project. This approach focuses on treating stormwater at the subwatershed level, emphasizing infiltration techniques, and restoration of natural hydrological functions where practicable. A subwatershed scale analysis of existing soil types, geology, and land use cover, interfaced with the existing Des Moines Creek Basin Plan, has been used to identify such opportunities (Olympic Associates Company 2002).

For the SR 509 freeway extension and South Access Road, stormwater runoff would be infiltrated where subsoil and groundwater conditions allow. In the I-5 corridor, stormwater runoff would be detained then released into stormwater treatment wetlands, where it would be infiltrated into the soil and cleansed by wetland plants. The infiltration facilities would be constructed only at the locations where groundwater is not near the surface, so infiltration from the bottom of the infiltration facilities would not be impeded by high groundwater. Infiltration facilities would not be located in the vicinity of public wells. Where infiltration is not feasible, stormwater runoff would be detained and receive enhanced treatment in most areas.

As a member of the Des Moines Creek Basin Planning Committee, WSDOT would help finance the CIPs included in the Plan if the project EIS is approved and project construction is funded. The primary goals of the Plan are to address water quality and quantity issues, to develop prioritized list of CIPs, and to improve the quality of human interactions with the creek. The implementation of this plan would reduce high flows and stream bank erosion, and slow degradation of wetlands, and fish and wildlife habitat in the basin. As a part of this plan, all WSDOT activities within Des Moines Creek Basin would comply with the basin plan.

One of the goals of the Des Moines Creek Basin Plan is to address elevated temperatures in Des Moines Creek. As part of the proposed project, trees and shrubs would be planted around detention ponds and along stream banks adjacent to the proposed alignment to provide shade and help lower stream temperatures.

Operation Mitigation Measures

Operation mitigation measures would include operation and maintenance of stormwater management systems, implementation of an accidental spill response plan, and discriminate use of de-icing materials and herbicides for vegetation management within the highway right-of-way.

Stormwater Treatment Outfalls

Outfalls from proposed stormwater treatment facilities would be designed to dissipate the energy of the discharged water to prevent streambed scouring. Where practical, outfalls would be designed to improve fish habitat in the stream by including an alcove of low-velocity water. Such an alcove would provide refuge during high flows to overwintering juvenile and migrating adult salmonids (King County 1998).

Stormwater Management

Potential measures to mitigate operational impacts on water resources would include implementing design specifications from a number of existing plans and regulations, including WSDOT's NPDES permit for stormwater runoff. WSDOT has a Municipal NPDES permit that regulates and defines methods to manage, control, and treat runoff from highways and associated shoulders within the project area. Through the NPDES permit process, WSDOT is required to provide water quantity control and water quality treatment for all new and reconstructed impervious surfaces to avoid or effectively mitigate impacts on water resources (WSDOT 1997). FAA design standards for airports place restrictions on the use of open water impoundments such as wet ponds and biofiltration swales because of their potential for attracting wildlife that could interfere with airport operations (FAA 1997). Permanent open water impoundments must be designed in such a manner that the open water is not visible to wildlife. Project elements constructed by the Port on its property (e.g., South Airport Link) would be included under the airport's NPDES permit and appropriate controls and conditions for those facilities would be developed in conjunction with that permit.

Vehicle access to stormwater and water quality treatment structures would be provided to allow operation and maintenance. The maintenance of all structures would be conducted according to the Stormwater Site Plan (SSP) prepared per WSDOT's *Highway Runoff Manual* (WSDOT 1995), WSDOT's RCP (WSDOT 1996), and King County's *Surface Water Design Manual* (King County 1998).

The outlets of facilities and interceptor swales would be designed to adequately dissipate the energy of discharged water before it reaches the receiving stream. Depending on the flow rates from the facility and the configuration of the system, this could be accomplished with a variety of structures, including rock pads, gabion outfalls, dispersion trenches, or level spreaders (King County 1998).

Accidental Spills Mitigation

To help control the spread of accidental spills during highway operation, the flow-control structures at stormwater detention facility outlets would be equipped with baffles and a spill-control separator to retain buoyant materials (lighter than water) such as petroleum products. Spilled liquids collected by the drainage system would thereby be detained in the stormwater detention facility until cleanup is complete.

Vegetation-Control Mitigation

Herbicide sprays to control vegetation would be applied only in dry weather under zero or mild wind conditions. In addition, spraying would be done only by a licensed sprayer. Precautions would be taken when spraying near sensitive water resources. Records would be maintained to keep track of the date, location, type, and amount of herbicides applied. Additional applicable guidelines for vegetation management, as outlined in WSDOT's RCP (WSDOT 1996), would be followed.

Bare or thinly vegetated ground surface areas within the right-of-way would be minimized, particularly on slopes. Where possible, grass vegetation could be used between the edge of pavement and roadside ditches and in earth-lined ditches to reduce erosion and encourage biofiltration of stormwater.

3.5.5 Construction Activity Impacts and Mitigation

Construction Impacts

Construction activities could introduce a variety of pollutants into surface waters, including sediment, fuel and lubricants, paving oils, chemicals, construction debris, and uncured concrete. Nutrients from seed mixtures applied for stabilizing soils and creating final landscaping have the potential to reach adjacent water resources.

Potential construction impacts on groundwater quality would include a range of pollutants used or generated during construction, such as petroleum products and construction waste. Pollution could result from accidental release of these substances, leaking storage containers, or construction equipment maintenance. The potential for construction impacts would be low because of the short period of construction and implementation of BMPs.

Well 1, Well 2, Well 2M, Tyee well, and two private wells are close to the proposed alignment of SR 509. During construction of the SR 509 roadway, WSDOT will work with the Highline Water District to ensure no contamination of the existing water supply. WSDOT would also coordinate with the private well owners. The construction BMPs and water quality monitoring and reporting of the stormwater runoff from the construction site will be implemented.

Mitigation Measures

Local, state, and federal government permit requirements would be implemented to mitigate potential construction impacts on surface and groundwater resources for all build alternatives. Stormwater, grading, and water quality-related permits required for the proposed project could include Hydraulic Project Approval (HPA), NPDES Permits for Construction and Operation of Sites Disturbing More Than 5 Acres, NPDES Permits For Construction Activity for Sites Greater than 1 Acre (Phase II of the NPDES Stormwater Program [U.S. EPA December 1999]), and local clearing, grading, and other permits.

To fulfill requirements of the construction NPDES permit, an SSP would need to be developed. The SSP would include measures for controlling erosion and sedimentation and preventing discharge of pollutants contained in stormwater to water bodies during construction and operation. The SSP would also include provisions for implementation of BMPs to protect groundwater and public drinking water supply, and measures to protect water and sewer lines, and construction monitoring. In developing the SSP, detailed data collection and analysis of local site conditions would be conducted. This would incorporate a thorough soils assessment, including jar tests, to determine potential for erosion and persistent water turbidity. Other site specific information on drainage, topography, ground cover, rainfall records, existing encumbrances, and water table elevation would be used in developing a Temporary Erosion and Sediment Control (TESC) plan.

The TESC plan is a required component of the SSP. In developing the TESC plan, appropriate construction BMPs would be selected for each of the particular types of anticipated construction activities. Implementing effective BMPs at construction sites, such as minimizing exposed soil surfaces and controlling erosion and sedimentation, would prevent or reduce potential impacts on surface water and groundwater quality. The King County *Surface Water Design Manual* (King County 1998) and WSDOT's *Highway Runoff Manual* (WSDOT 1995) would be used for BMP selection and design criteria. BMPs for the types of construction activities anticipated typically include the following:

- Phasing construction to minimize the amount of earth exposed at any one time to erosive forces

- Designing construction entrances, exits, and parking areas to reduce tracking of sediment onto public roads
- Using vegetative erosion-control practices (seeding, mulching, soil conditioning with polymers, flocculants, sod stabilization, vegetative buffer strips, and protection of trees with construction fences)
- Implementing erosion-control practices (mulching, erosion-control blankets, and application of soil tackifiers)
- Implementing sediment-control practices (straw bales, silt fences, check dams, sediment traps, sedimentation basins, and flocculation methods)
- Controlling erosion of stockpiled materials (e.g., diverting upslope water around stockpiles, covering stockpiles, and placing silt fences around stockpiles)
- Preserving the permeability of pervious areas within the project construction site to the greatest extent practical
- Performing routine operation and maintenance of erosion and sediment control BMPs.

If construction takes place during the wet season (October 1 through April 30), exposed soils would be subjected to additional controls specified in King County's erosion and sedimentation control standards (King County 1998).

A Spill Prevention Control and Countermeasures (SPCC) plan would be adopted as a construction planning element of the proposed project to reduce accident-related water quality impacts (Wilson pers. comm. 1999). The plan would specify the responsibilities of those involved during accidental spills.

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