## 3.5 WATER RESOURCES

This section describes the surface water and groundwater impacts of the I-405 Corridor Program. Note that impacts to floodplains and wetlands are covered in Sections 3.10 and 3.6.

### 3.5.1 Studies and Coordination

#### *3.5.1.1 Plans and Policies*

The following plans, policies, and codes were used in the analysis of impacts for ***surface water:***

- *Stormwater Management Manual for the Puget Sound Basin*, Washington State Department of Ecology, 1992.
- *Stormwater Management Manual for Western Washington*, Washington State Department of Ecology, 2001.
- *Highway Water Quality Manual*, Washington State Department of Transportation, 1988.
- *Highway Runoff Manual*, Washington State Department of Transportation, 1995.
- Washington Administration Code (WAC) 173-270-050 ("Puget Sound Highway Runoff Program"), 2001.
- WAC 173-270-060(5)(a) Long-Range Program for Stormwater Retrofit of Existing Highways, 2001.
- Manuals and guidelines of local jurisdictions, including King County's *Surface Water Design Manual, 1998* and Snohomish County's Title 24, 1999. (Most of the local jurisdictions either have their own manual or have adopted the Ecology manual.)
- Endangered Species Act (ESA), Tri-County Response information, 2000 and 2001.
- WAC 173-201A, Water Quality Standards for Surface Water of the State of Washington, 2001.

The following plans, policies and codes were used in the analysis of impacts and the determination of mitigation for ***groundwater:***

- Redmond-Bear Creek Valley Ground Water Management Plan, Redmond-Bear Creek Ground Water Advisory Committee
- Appendix Q, Wellhead Protection Plan, City of Renton Water System Plan
- Wellhead protection programs and aquifer protection programs, cities of Redmond, Renton, and Kent

The following regulations and programs are relevant to the evaluation of impacts of the I-405 Corridor alternatives on ***groundwater supply and quality***:

- Sole Source Aquifer Protection Program, USEPA
- Federal Safe Drinking Water Act, WAC 246-290-310
- Source Water Protection, WAC 246-290-135
- Wellhead Protection Program, WAC 246-290-135 (3)

- Washington State Growth Management Act, Chapter 36.70A RCW
- Ground Water Management Areas and Programs, WAC 173-100
- Water Quality Standards for Ground Waters, WAC 173-200
- Renton Aquifer Protection Ordinance, Renton Amd. Ord. 4851, 8-7-2000

#### *3.5.1.2 Agencies and Jurisdictions*

The compilation of information for surface water included discussions with agencies and municipalities in the I-405 corridor including:

- City of Bellevue
- City of Kent
- City of Redmond
- City of Renton
- City of Kirkland
- King County Department of Natural Resources (DNR), Water and Land Resources Division
- Snohomish County
- WSDOT

The following agencies were contacted for information regarding the groundwater impacts evaluation:

- U.S. Environmental Protection Agency (USEPA) Region 10, Groundwater Protection Unit
- U.S. Geological Survey (USGS)
- Washington State Department of Ecology (Ecology)
- Washington State Department of Health (DOH)
- Washington State Department of Natural Resources (DNR)
- King County Department of Health
- King County Department of Natural Resources, Water and Land Resources Division
- King County Department of Development and Environmental Services (DDES)
- Snohomish County Department of Health
- Snohomish County Department of Planning and Development Services

The cities of Lynnwood, Bothell, Kirkland, Redmond, Bellevue, Renton, and Kent were contacted about their public water supplies, wellhead protection programs, and sensitive area ordinances.

## 3.5.2 Methodology

### *3.5.2.1 Surface Water*

#### Surface Water Quantity

Existing rivers, streams, and lakes within the study area and their associated drainage basins were mapped using GIS information made available from King and Snohomish counties. The drainage basins' boundaries and stream network were then refined using USGS quadrangle maps of the study area.

Summary flow data for the major streams in the study area were obtained from the National Water Information System of the USGS, available on the World Wide Web. This was supplemented by information in the USGS-published annual reports, *Water Resources Data for Washington*.

#### Surface Water Quality

Construction, operation, and maintenance of roadways and HCT facilities discharge pollutants to water bodies. These pollutants include silt, chemicals, paints, and solvents and fuels used by construction equipment. Pollutants from operations may include silt, hydrocarbons, metals, nutrients, and pathogens due to traffic and airborne deposition. Similar pollutants are generated by maintenance activities, particularly silt, pesticides, and de-icing materials.

The Washington Administrative Code (WAC) was reviewed for the current water quality standards for each of the major streams in the study area (see *I-405 Corridor Program Draft Surface Water Resources Expertise Report*, [CH2M HILL, 2001a]). The 303d List published by Ecology, available from the department's Web home page, was used to identify water bodies that did not meet standards. These streams were added to the project GIS database and plotted. The 303d List identified water bodies that are not expected to meet water quality standards over the near to medium term. This list is updated every two years as more water quality data become available. However, it is not a comprehensive list of all water bodies failing to meet water quality standards.

A listing of existing stormwater facilities for I-405 and other major state highways in the study area was developed. Opportunities for retrofit of existing highway stormwater facilities were then identified generally.

Long-term annual pollutant loads along I-405 were estimated using the methods described in the WSDOT *Highway Water Quality Manual* (WSDOT, 1988). As noted in Section 3.5.3.1, there are a number of stormwater treatment facilities currently installed along I-405. The standard water quality treatment provided by these facilities can reduce suspended solids by 80 percent, with considerably smaller reductions in other pollutants, such as nutrients and metals. The effectiveness of these existing stormwater facilities in reducing overall highway pollutant loads has not been quantified regionally. However, the actual pollutant loadings to surface waters in the study area are likely somewhat lower than the amounts calculated for this analysis, which assume no runoff treatment.

Estimates of new impervious surface associated with the proposed highway and road projects were prepared, based upon standard lane widths, project lengths, and other appropriate areal factors. Estimates of total impervious area (TIA) for each of the basins were provided by the King County DNR (Hartley and Burkey, personal communication, January 26, 2000). Digitized

1998 aerial photos were analyzed electronically with visual verification of test areas by staff of the Center for Urban Water Resources at the University of Washington. The procedure produces estimates of impervious surface coverage within one percent accuracy for areas greater than one square mile (640 acres) (Hill et al., 2000).

Roadways, parking areas, transit stations and platforms, and other types of transportation facilities can impact water resources in a number of ways. The pavement or hard surface created by a road, ballasted rail line, or roof is known as impervious surface. Replacement of forest and vegetation with cleared right-of-way and pavement or other impervious surface substantially reduces the amount of rainfall that is evaporated back into the air and the portion that is infiltrated into the soil. As a result, these impervious or less pervious areas are warmer and drier and create higher peak stream flows and more rapid changes in stream flows than forested areas. Summer base flows tend to be reduced. Transportation facilities within riparian corridors can impact the functions of riparian areas and reduce or isolate floodplain capacity. Facilities that cross water bodies can directly affect stream channels, reducing stream channel cross-section or diverting the location of the channel.

A qualitative assessment of impacts to stream flow and water quality was carried out using new impervious surface area attributable to the set of proposed projects within each alternative as the primary indicator. The following criteria were used to define potential important surface water impacts:

- Multiple projects within an alternative (five or more with each disturbing greater than one acre) occurring within basins with a high proportion of steeply sloping area were judged to result in potentially serious water quality impacts during construction.
- Potentially serious operational impacts were judged to occur within basins experiencing a substantial increase in impervious surface (one percent or greater of total basin area per project) which could result in a permanent reduction in stream base flow.
- A number of streams in the study area currently violate water quality standards for temperature and/or heavy metals. If the alternative results in a substantial increase in impervious area in such a basin (one percent or greater of total basin area per project), the associated decrease in base flow could worsen the stream temperature problem. Increased road runoff could intensify metals concentrations in such a stream. Either of these situations was judged to be a potentially substantial operational impact to water quality.

The impact analysis assumes that as part of each project, the standard erosion and sediment control measures and permanent stormwater detention and treatment requirements specified in the *Stormwater Management Manual for Western Washington* published by Ecology in August 2001 or functionally equivalent stormwater guidance would be implemented. WSDOT has two years from the date of publishing to revise its *Highway Runoff Manual* to meet the requirements in the Ecology manual.

The surface water analyses in this section are based on the *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001), herein incorporated by reference.

#### *3.5.2.2 Groundwater*

A program-level groundwater analysis was conducted to evaluate the effects of each alternative on groundwater quality and quantity. Specifically, the evaluation was based on the following two key technical issues:

1. Would the project adversely decrease the quality of groundwater that is a current or future water supply for areas within the study corridor?
2. Would the project adversely decrease the quantity of groundwater that is a current or future water supply, or that serves as base flow for surface water bodies within the study corridor?

To address these issues, the primary groundwater resources (i.e., aquifers) within the study corridor were identified, including those designated as sole-source aquifers (SSAs). Public and private water supply wells within the study corridor were identified and mapped, and additional hydrogeologic data were obtained from cities for which groundwater is the primary source of drinking water. The potential for groundwater to be affected by contamination was evaluated based on hydrogeology, well locations relative to projects, susceptibility ratings assigned by the Washington State DOH, and wellhead protection areas (WHPAs). The potential for reduced groundwater recharge was evaluated based on surficial geology and critical aquifer recharge area ratings (CARA) assigned by King County DDES and total new impervious surface area estimated under each alternative. The data measures and evaluation criteria for groundwater evaluation are described in detail in the *I-405 Corridor Program Draft Groundwater Resources Expertise Report* (CH2M HILL, 2001b).

The alternatives were divided into sections, then analyzed for:

- Sections that crossed one or more of the groundwater resources: wellhead protection areas, sole-source aquifers, or critical aquifer recharge areas.
- Sections with relative amounts of total new impervious surface area for each alternative within the given section. Generally, the alternative with the higher total new impervious surface area would have a higher potential for impacts.

The analysis was relative only and did not attempt to determine whether potential impacts were substantial. Following the relative ranking of alternatives, a determination based on professional judgement was made as to whether impacts to groundwater quality or quantity were substantial using the following criteria:

- Impacts to groundwater *quality* were considered substantial if groundwater quality at a public water supply well would be degraded to a point where it exceeded primary federal drinking water standards (Safe Drinking Water Act) or state drinking water standards (WAC 246-290-310).
- Impacts to groundwater *quantity* were considered substantial if the supply of groundwater was depleted such that flow to groundwater-fed water resources (e.g., springs and perennial surface water flows) used by other "users" such as fisheries and recreation was substantially reduced.

The groundwater analyses in this section are based on the *I-405 Corridor Program Draft Groundwater Resources Expertise Report* (CH2M HILL, 2001), herein incorporated by reference.

### 3.5.3 Affected Environment

The I-405 Corridor study area contains abundant water resources. Major surface water features include two large lakes, three rivers, eleven major streams, and numerous smaller lakes and streams. The study area lies within two state Water Resource Inventory Areas (WRIAs). The southern ten percent lies within WRIA 9 – Green-Duwamish River Basin. The remainder lies within WRIA 8 – Lake Washington Basin (Cedar-Sammamish rivers). Both WRIAs drain to Central Puget Sound a few miles downstream of the study area. The upper portions of the Green and Lake Washington basins have undergone relatively little development and most of the land cover is second-growth forest. The lower portions of these basins, in contrast, have undergone extensive land use changes in the form of either agriculture or urban and residential development. Similarly, the basins of the major streams in the study area are also largely developed or are experiencing relatively rapid growth.

#### *3.5.3.1 Surface Water*

This section briefly describes the major basins within the study area. These basins and related data are described in more detail in the *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a). Figure 3.5-1 shows the following major streams and lakes within the study area:

- **Soos Creek** drains an urbanizing area of south King County. This stream rises in the eastern side of the study area and flows south for 10 miles. It then turns west and joins the Green River just upstream of the city of Auburn. The stream remains one of the most important salmon streams within the urban portions of King County. The hydrology and water quality of this stream have not been as dramatically altered as many of the other streams in the study area. This basin covers 9,400 acres within the study area. Total impervious area (TIA) coverage within the study area is 17 percent.
- The **Green River** rises in the Cascade Mountains 50 miles southeast of the study area. Its flow is partially controlled by Howard Hanson Dam, operated by the Army Corps of Engineers, and by the City of Tacoma's water diversion dam. It enters the low-gradient Kent-Auburn valley and flows north into the study area at Kent. The river has been channelized through the valley. At its junction with the Black River near the border of the study area, the Green River becomes known as the Duwamish River. I-405 crosses the Green River a short distance upstream of this point. This basin covers about 3,000 acres within the study area. TIA coverage within the study area is 39 percent.
- **Springbrook Creek** flows north through the Kent-Auburn valley and generally parallel to the Green River. It receives runoff from Garrison Creek and Mill Creek (Kent), as well as from most of the valley and the plateau to the east. Its drainage area includes downtown Kent. Within the valley floor, this stream channel has been heavily altered, although substantial areas of wetland remain. This stream joins the Black River a short distance above its confluence with the Green River. I-405 crosses the creek at about this point. This basin covers about 14,300 acres within the study area. TIA coverage is 44 percent.
- The **Cedar River** rises in the Cascade Mountains, immediately north of the Green River Basin, 45 miles southeast of the study area. It flows through Chester Morse Reservoir (operated by the City of Seattle), past the town of Maple Valley, and down the Cedar River

**Legend: Stream Basins**

Streams
Drainage Basins
East Lake Washington — Drainage Basin Labels
Study Area Boundary
County Boundaries
Highways
Roadways
Railways
N
1 0 1 2 3 Miles

Mill Creek
Lynnwood
Edmonds
Woodway
Mountlake Terrace
Brier
Bothell
Kenmore
Shoreline
Lake Forest Park
Woodinville
SNOHOMISH
KING
Duvall
Sammamish
Issaquah
Redmond
Kirkland
Lake Washington
Lake Washington Ship Canal
Portage Bay
Union Bay
Lake Union
Hunts Point
Clyde Hill
Medina
Bellevue
Lake Sammamish
Seattle
Beaux Arts
Mercer Island
Duwamish River
Newcastle
Tukwila
Renton
Burien
Normandy Park
SeaTac
Des Moines
Kent
Auburn
Covington
Maple Valley
Federal Way

North Creek
Swamp Creek
Little Bear Creek
North Lake Washington
Bear Creek
East Lake Washington
Juanita Creek
Sammamish River
Forbes Creek
Evans Creek
Kelsey Creek
Mercer Slough
West Lake Sammamish
Mercer Island
East Lake Washington
Coal Creek
East Lake Washington
May Creek
East Lake Washington
Black River/Springbrook Creek
Lower Green River
Lower Cedar River
Soos Creek

Simmons Route
NE 128th St
Redmond Fall City Rd
NE 8th St
148th Ave SE
Coal Creek Pky SE
SE 128th St
SE Petrovitsky Rd
68th Ave
132nd Ave SE

5 405 90 99 509 167 515 169 18 516 527 524 522 202 203 520 900

**Stream Basins in the I-405 Corridor Study Area**

Figure No. 3.5-1

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valley to Renton. The river discharges into the south end of Lake Washington at Renton. I-405 crosses the river a little more than one mile above its mouth at Lake Washington. This basin covers a little less than 14,000 acres within the study area. TIA coverage specific to the study area was not available.

- **May Creek** rises in rural King County, east of Renton. I-405 crosses the stream near its mouth, a short distance above Lake Washington. This basin covers about 5,900 acres within the study area. TIA coverage is 22 percent.
- **Coal Creek** rises on Cougar Mountain, 4 miles east of Lake Washington. The creek suffers from excessive sedimentation due primarily to landslides. I-405 crosses this stream about a mile above its mouth. This basin covers about 3,000 acres within the study area. TIA coverage is 28 percent.
- The **Kelsey-South Kelsey, Forbes,** and **Juanita basins** drain much of the cities of Bellevue and Kirkland. Kelsey Creek drains to Mercer Slough, an important wetland area bordering Lake Washington. Major portions of these creeks and their tributaries have been heavily altered. I-405 crosses these streams generally along their middle reach. Collectively, these basins cover about 17,000 acres within the study area. TIA coverage is 45 percent.
- The **East Lake Washington Basin** includes the smaller streams that flow directly to the lake. This basin extends along the eastern shore of Lake Washington but excludes the mouths of the larger Lake Washington streams mentioned above. It covers about 13,000 acres within the study area, and TIA coverage is 40 percent.
- **Lake Sammamish** is a 5-mile-long lake located along the eastern edge of the study area. The city of Issaquah lies at the south end of the lake. Tibbetts and Issaquah creeks are the largest tributaries to the lake. They drain a mountainous, largely forested area south and east of the lake.
- The **Sammamish River** flows from the north end of Lake Sammamish near Redmond to the north end of Lake Washington. The Sammamish River Valley is low-gradient and ranges from several miles to about one-quarter mile wide. After first flowing north through Marymoor Regional Park, the river passes through downtown Redmond, then through a commercial and office complex and a golf course. After passing through the City of Woodinville, the river turns west, flowing through Bothell and Kenmore and into Lake Washington. The river itself was channelized decades ago. I-405 crosses the Sammamish River in Bothell, about 4 miles east of Lake Washington. This basin covers about 16,400 acres within the study area. TIA coverage is 37 percent.
- **Bear Creek** joins the Sammamish River at Redmond, a short distance downstream of where the river flows out of Lake Sammamish. Much of the riparian area along this stream has remained undeveloped and the stream supports important salmon runs. **Evans Creek** is an important tributary to Bear Creek. The Bear Creek Basin lies to the east of I-405, but several highway or arterial projects could affect this basin. This basin covers about 11,000 acres within the study area. TIA coverage is 23 percent.
- **Little Bear Creek** joins the Sammamish River at Woodinville. Its lower stretch has been extensively channelized. The Little Bear Basin covers about 3,000 acres within the study area. TIA coverage is 28 percent.

- The upper portions of **North** and **Swamp creeks** lie within the cities of Mill Creek and Lynnwood. I-405 crosses Swamp Creek a short distance south of I-5, in the north portion of the study area. Snohomish County has constructed a regional detention facility along the middle stretch of Swamp Creek, just upstream of I-5, to help alleviate downstream flooding. The lowest stretch of North Creek, where it crosses I-405, is also planned for wetland preservation and enhancement. Collectively, these two basins cover about 15,000 acres within the study area. TIA coverage is 39 percent.
- **Lake Washington** forms the western side of the study area. It averages one to three miles in width and extends 18 miles from Renton to Kenmore. It is one of the largest lakes in Washington, and approximately 90 percent of the study area drains to this lake. Its two largest tributaries are the Cedar and Sammamish rivers. On its western shore, opposite the study area, is the City of Seattle.

The overall total impervious area coverage within the 134,000-acre study area is approximately 36 percent. Individual basins range from 17 percent impervious area for the Soos Creek Basin to 55 percent impervious area for the Duwamish River Basin. Research on urban streams by the University of Washington Center for Urban Water Resources suggests that substantial declines in stream invertebrate populations and other measures of stream health occur when development within a basin reaches about 10 percent impervious area (May et al., 1997).

The State has classified all surface water bodies into five water quality categories: Class AA, Class A, Class B, Class C, or Lake Class. Class AA are typically waters of extraordinarily good quality, while Class A waters are classified as excellent quality (WAC 173-201A-120). Table 3.5-1 shows the water quality classifications of the major surface water bodies in the study area. By regulation, all streams draining to lakes, and not otherwise specifically designated, are Class AA.

**Table 3.5-1: Classification of the Major Streams and Lakes**

| WATER BODY | State WQ Class | King Co. Stream Class |
|---|---|---|
| Bear-Evans Creek | AA | 1 |
| Cedar River | A[a] | 1 |
| Coal Creek | AA | 2 |
| Duwamish River | B | 1 |
| Forbes Creek | AA | Unclassified |
| Juanita Creek | AA | 2 |
| Kelsey Creek | AA | 1 |
| Green River | A | 1 |
| Little Bear Creek | AA | 2 |
| Sammamish River | AA | 1 |
| May Creek | AA | 2 |
| North Creek | AA | 1 |
| Soos Creek | A | 2 |
| Springbrook Creek | A | 2 |
| Swamp Creek | AA | 1 |
| Lake Sammamish | Lake | Not Applicable |
| Lake Washington | Lake | Not Applicable |

[a] Class AA above RM 4.1

King County Stream Classification refers to the general size of the stream. Class 1 covers the larger streams, which are "Shorelines of the State" as defined under the County Shoreline Master Program. Class 2 streams are other perennial streams or streams used by salmon. Class 3 are intermittent streams which are not utilized by salmon. The three rivers and half of the major streams in the study area are Class 1. Most of the remaining streams are Class 2 – other streams supporting salmon.

Every two years, Ecology publishes a statewide water quality assessment known as the Section 305b Report. It includes a list of impaired and threatened water bodies, known as the "303d List," and the parameters that do not meet state water quality standards. This list is not comprehensive in that streams with potential water quality problems, but inadequate water quality data, would not necessarily be on the list. However, it does serve as a useful source of information on water quality problems at the regional level considered in this document. About one-third of the water bodies violate the temperature standard. Some of the lower-gradient, sluggish streams in the study area violate the dissolved oxygen standard. The Green River and Springbrook, May, and Bear-Evans creeks show elevated levels of one or more heavy metals. The Sammamish River has a pH violation, while Kelsey Creek has shown elevated levels of three pesticides.

Streams on the 303d List are required to undergo a study which leads to an allocation of allowable input of the offending pollutants such that water quality standards can be achieved. This allocation is known as Total Maximum Daily Load (TMDL). In 1993, Ecology assigned a TMDL to the Lower Green/Duwamish River for ammonia-nitrogen. A TMDL covering coliform bacteria is under consideration for North Creek.

Ecology has issued to WSDOT a Phase 1 NPDES Municipal Stormwater Permit. Under this permit, WSDOT has developed a stormwater treatment and management program for runoff from its highways. In addition, all construction projects disturbing an area greater than five acres, including road projects, must comply with the provisions of the State's general construction permit. Projects must provide adequate erosion and sediment control measures, as well as permanent stormwater control measures. A Stormwater Pollution Prevention Plan (SWPPP) detailing these measures must be developed and be available for inspection at the construction site.

Among other requirements, temporary and permanent stormwater control measures similar to those found in Ecology's *Stormwater Management Manual for Western Washington* are likely to be required, as well as substantial commitments to operation and maintenance of stormwater facilities. Along I-405 there are 37 detention facilities, 12 water quality treatment facilities, and 7 combined facilities (WSDOT, 2000). Information on the specific portions of I-405 served by these facilities was not available. However, the northern portion of I-405 has more stormwater facilities in operation than the southern portion.

#### *3.5.3.2 Groundwater*

The regional hydrogeology for Puget Sound consists of highly variable sequences of glacial, interglacial, and alluvial deposits and is described in detail in the *I-405 Corridor Program Draft Groundwater Resources Expertise Report* (CH2M HILL, 2001b). There is no substantial regional groundwater flow system. Instead, groundwater movement is generally from topographic high to topographic low, usually toward stream drainages. Groundwater in the uppermost aquifer unit generally occurs under water table conditions; groundwater in the deeper

units is semiconfined. Recharge is generally in higher elevation areas where semiconfining layers are not present, and groundwater discharges to stream drainages.

Groundwater quality is suitable for most purposes. The water is generally soft to moderately hard. In some of the glacial aquifers, high concentrations of iron and manganese are common.

The majority of the cities within the study area are supplied by surface water. Redmond is in the Redmond-Bear Creek Valley Groundwater Management Area, and Kent and part of Renton are in the South King County Groundwater Management Area. Renton obtains its groundwater from the Cedar Valley aquifer, which is designated as a sole-source aquifer by the USEPA. See Figure 3.5-2 for location of sole-source groundwater aquifers and recharge areas and Figure 4.2 in the Draft Groundwater Expertise Report for the WHPAs of Class A wells and the locations of Class B wells.

#### *3.5.3.3 Sole-Source Aquifers*

There are two sole-source aquifers within the study corridor: the Cedar Valley aquifer (a narrow strip along the Cedar River) and a small portion of the Cross Valley aquifer, all stream-flow source areas.

### 3.5.4 Impacts

This section discusses the overall runoff and water quality impacts of each alternative due to construction and operation of the improvement projects. Project impacts were quantified according to their effects upon discrete hydrologic elements such as surface water basin or wellhead protection area (see Table 3.5-2).

**Table 3.5-2: Summary of Water Resources Impacts**

| Impact | No Action Alternative | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Preferred Alternative |
|---|---|---|---|---|---|---|
| **Surface Water:** | | | | | | |
| Acres of New Impervious Area | 173 | 478 | 820 | 773 | 1,061 | 974 |
| # Basins – Construction Impacts | 1 | 8 | 11 | 10 | 8 | 11 |
| # Basins – Base Flow Impacts | 0 | 0 | 6 | 3 | 7 | 6 |
| # Basins – Water Quality Impacts | 0 | 0 | 1 | 0 | 1 | 1 |
| **Groundwater:** | | | | | | |
| Public Wells | 8 | 14 | 38 | 40 | 38 | 40 |
| Other Wells | 29 | 70 | 156 | 183 | 154 | 183 |
| Wellhead Protection Areas (WHPAs) | 7 | 10 | 16 | 17 | 17 | 17 |
| Sole Source Aquifers (SSAs) | 2 | 2 | 2 | 2 | 2 | 2 |
| Critical Aquifer Recharge Areas (CARAs) | 3 | 3 | 5 | 5 | 6 | 5 |
| Recharge area decrease (acres) | 104 | 215 | 410 | 387 | 531 | 487 |

Road and highway projects can negatively impact water resources in a number of ways. Replacement of native or second-growth forest cover with cleared road right-of-way, ditches, road shoulders, and road pavement substantially increases hard-surfaced (impervious) areas and greatly reduces the time period for runoff. These impervious areas have the effect of reducing the amount of rainfall that is evaporated back into the air. In addition, rainwater infiltration into the soil is also

**Legend: Sole Source Aquifers and Critical Aquifer Recharge Areas**

- Sole Source Aquifers
- Low CARA Areas
- Medium CARA Areas
- High CARA Areas
- Study Area Boundary
- County Boundaries
- Highways
- Roadways
- Railways

N

1 0 1 2 3 Miles

Source: Sole Source Aquifer Petition for the Cedar River Aquifer, Renton, Washington, Nov. 1988

SNOHOMISH

KING

Mill Creek
Lynnwood
Edmonds
Woodway
Mountlake Terrace
Brier
Bothell
Kenmore
Shoreline
Lake Forest Park
Simonds Rd NE
Woodinville
Duvall
Kirkland
Redmond
8th St
Lake Washington
Union Bay
Lake Union
Yarrow Point
Hunts Point
Clyde Hill
Medina
NE 8th St
Bellevue
148th Ave SE
Redmond Fall City Rd
Lake Sammamish
Seattle
Beaux Arts
Mercer Island
Sammamish
Issaquah
Duwamish River
Newcastle
Coal Creek Pky SE
Tukwila
SE 128th St
Renton
Burien
Normandy Park
SeaTac
SE Petrovitsky Rd
68th Ave
132nd Ave SE
Kent
Des Moines
Covington
Maple Valley
Auburn
Federal Way

Sole Source Aquifers and Critical Aquifer Recharge Areas

Figure No. 3.5-2

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greatly reduced. As a result, runoff from road areas can be greatly increased over that of natural conditions. This can result in higher peak flows in the receiving streams. Since groundwater recharge is reduced, summer base flows in the receiving streams can also decline. Roadways built within riparian corridors can impact the functions of riparian areas and reduce or isolate floodplains. Table 3.5-2 summarizes impacts on water resources in the study area by alternative.
In addition to the quantitative measures of groundwater impacts summarized in Table 3.5-2, professional judgement was used to develop an overall qualitative measure of impact using a high, medium, and low scale.

### *3.5.4.1 No Action Alternative*

#### Construction Impacts

Surface Water

The projects proposed under the No Action Alternative would have the potential to temporarily degrade water quality during construction. Standard best management practices (BMPs) for control of erosion and other pollutants would be implemented during construction, as required by the *Stormwater Management Manual for Western Washington* or functionally equivalent stormwater guidance. These would minimize erosion and sedimentation to water bodies. However, one of the basins (North Creek) could suffer serious short-term water quality degradation due to a combination of its steeper gradient and the relatively high number of projects proposed for construction (five or more) within its boundaries. Wet-weather construction within this basin may seriously degrade water quality. Substantial short-term impacts can be avoided by implementing the wet-weather practices discussed in Section 3.5.5, Mitigation Measures.

Groundwater

The use of hazardous materials during construction near wells, wellhead protection areas (WHPAs), sole-source aquifers, and CARAs may result in direct impacts to groundwater. Potential sources of hazardous materials related to construction include: fuel used by construction vehicles; chemicals used during construction, such as cement curing aids, formcoats, and sealants; and fill material brought in from outside sources that may contain hazardous materials. Similarly, if hazardous materials are present in soil that is newly exposed during construction, it is another source of contamination through direct infiltration and surface runoff.

Eight public water supply wells occur within one-quarter mile of the No Action Alternative projects. Four WHPAs would be intersected by new construction; all four are in the Renton area. In Redmond, two arterial projects would be on the edge of the 1-year WHPA, but would not penetrate the area. In Renton one arterial would pass through the 10-year capture zone for the Maplewood Wells. None of the projects would be within the Aquifer Protection Area (APA) zones.

In Snohomish County, Project HOV-14 (I-405 Segment 9), and portions of 2 other arterials would cross medium aquifer recharge areas (ARAs). In the Redmond area, two arterials would cross CARAs, and two would be on the outer edge of CARAs. In Renton, R-39 would have a portion in a high ARA, and the remainder in a low ARA. Two projects would be in ARAs in the

Kent Green River Valley. About 60 percent of the No Action Alternative projects would cross potential recharge areas.

Multiplying the total new impervious surface area of 173 acres by 60 percent yields a value of 104 acres for the potential recharge area that could be lost as a result of the placement of new impervious surfaces.

Activities that might remove substantial quantities of groundwater from aquifers during construction are pump tests and construction dewatering activities. These would be expected to occur in the areas where groundwater is near the surface, such as downtown Redmond, Renton, near the Cedar River, and in the Kent/Green River valley. The No Action Alternative would have very few projects in these areas. Additionally, since the construction period would be short compared with the operational period, the potential for loss of groundwater supply due to the placement of impervious materials on groundwater recharge areas is low. Therefore, the potential for construction activities for the No Action Alternative to negatively impact groundwater quantity and quality is low.

#### Operational Impacts

##### Surface Water

The No Action Alternative would result in 173 acres of new impervious surface within the study area. This would represent approximately a 0.1 percent increase in impervious area across the study area. The North Creek Basin would receive the most new impervious surface, 33 acres. Other basins receiving 15 or more acres of new impervious surface include Sammamish River and Little Bear Creek. The Lower Green and Duwamish rivers and Bear, Coal, Forbes, and Kelsey creeks would each receive less than 5 acres of new impervious surface. On a relative basis, Evans and North creeks would experience the greatest impact, about 0.5 percent increase in impervious surface each.

The proposed road projects under this alternative would result in an increase in runoff to local drainage systems and streams. The standard detention requirements for new projects would be generally sufficient to avoid causing or intensifying downstream drainage or flooding problems. Given the small relative decreases in pervious surface likely to occur in any single basin, it is doubtful that any measurable reduction in base flow would occur.

Annual pollutant loads attributable to traffic along I-405 under the No Action Alternative were calculated. Increases would occur in chemical oxygen demand (COD), zinc, copper, total nitrogen, and total phosphorus, including approximately 379 tons per year of suspended sediment along the entire length of I-405.

Stormwater treatment would be implemented during design and construction for new impervious surfaces associated with each of the new projects proposed as part of this alternative. WSDOT is currently revising its *Highway Runoff Manual* to be functionally equivalent to Ecology's *Stormwater Manual*. The proposed criteria would take into consideration impacts to fish, including chinook salmon. The criteria are also expected to be used by WSDOT in retrofitting existing stormwater quantity and quality systems along the corridor. The overall operational impact of the No Action Alternative upon surface water is judged to be below the threshold of significance.

Groundwater

The primary potential operational (long-term) impacts to groundwater quality would be related to traffic passing through WHPAs, APAs, SSAs, and CARAs. Accidents in which hazardous materials are released onto these areas could contaminate groundwater. Release of small amounts of hazardous materials over time via vehicle fuel, lubricant, or other fluid leaks could be picked up by runoff and, if not contained and treated, could reach the ground and infiltrate to groundwater.

With few projects in these areas, the potential for these impacts under normal operating conditions for the No Action Alternative would be low. However, it is possible that a truck transporting large quantities of hazardous chemicals could conceivably be involved in a traffic accident that would cause the release of a large volume of chemicals that could run off of the roadway and onto soil. If this occurred in a WHPA, APA, SSA, or CARA, then groundwater impacts could be high and substantial. Over time, the potential lost groundwater recharge associated with general road projects could be higher than during construction.

The potential for operational impacts associated with the No Action Alternative to degrade groundwater quality or to decrease groundwater supply under normal conditions is low and not substantial, with the exception of the traffic accident scenario described above, in which impacts to groundwater quality could be substantial.

### *3.5.4.2 Alternative 1: HCT/TDM Emphasis*

#### Construction Impacts

Surface Water

Under Alternative 1, eight basins would have five or more projects constructed within their boundaries. These projects would have the potential to temporarily degrade water quality during construction. Several of the stream basins would potentially suffer serious, short-term water quality degradation due to a combination of their sloping nature and the relatively high number of projects proposed for construction. These would include East Lake Washington, the Sammamish River, and Forbes, Springbrook, Juanita, North, and South Kelsey creeks. Substantial short-term impacts would be avoided by implementing water quality protection BMPs during construction.

Groundwater

Alternative 1 projects would pass within one-quarter mile of more wells than the No Action Alternative, and cross more WHPAs and high CARAs. Where the same WHPAs and CARAs are crossed, the crossing area would be larger. The additional projects and additional surface area relative to the No Action Alternative would increase the potential for groundwater contamination during construction by increasing the number of construction vehicles, the fueling requirements, the amount of fill imported, the areas where leaks and spills could occur, and the potential for exposing contaminated soils. The primary areas of concern are Redmond and Renton.

Based on the increased intersection of sensitive areas (i.e., WHPAs, APAs, CARAs, and SSAs) by projects in Alternative 1, the potential for construction impacts to groundwater quality is rated moderate.

The potential for construction-related decrease of aquifer recharge would be greater compared with the No Action Alternative as a result of increased impervious area. However, the construction period would be relatively short in terms of recharge times. The potential for Alternative 1 construction activities to decrease groundwater quantity is low. Although some potential exists for construction activities to impact groundwater quality and quantity, the impacts that may occur are not substantial.

An estimated 45 percent of the Alternative 1 projects would cross potential recharge areas. Multiplying the total new impervious surface area of 478 acres (which includes the No Action Alternative) by 45 percent yields a value of 215 acres for the potential recharge area that may be lost as a result of the placement of new impervious surfaces.

### Operational Impacts

#### Surface Water

Alternative 1 would result in 478 acres (including the No Action Alternative) of new impervious surface within the study area. This would represent an increase of 0.4 percent in impervious area across the study area.

The HCT system evaluated in Alternatives 1 and 2 extends north on an exclusive alignment from Tukwila to Lynnwood, with connections west across Mercer Island, east to Issaquah, and northeast to Redmond. The system also includes HCT stations, platforms, and a maintenance and storage facility. With the assumed ballasted guideway calculated as 50 percent pervious, the HCT system results in a total of 167 acres of impervious surface. Depending on the HCT technology used and final design, this total could be higher or substantially lower. By comparison, the two additional lanes on I-405 under Alternative 3 result in a net increase of 97 acres of impervious surface after subtracting the basic improvement projects that would no longer be needed.

The Springbrook Creek Basin would receive the most new impervious surface, 83 acres. Other basins receiving more than 15 acres of new impervious surface would include Sammamish and Cedar rivers and Juanita, Forbes, South Kelsey, and North creeks and East Lake Washington Basin. The Lower Green and Duwamish rivers would each have less than 5 acres of new impervious surface. On a relative basis, South Kelsey Creek would experience the greatest impact, about a 0.9 percent increase in impervious surface. Forbes, Juanita, and North creeks would experience an increase of 0.7 percent impervious surface.

The proposed road projects under this alternative would result in an increase in runoff to local drainage systems and streams. The standard detention requirements for new projects would be generally sufficient to avoid causing or intensifying downstream drainage or flooding problems.

Annual pollutant loads attributable to traffic along I-405 under Alternative 1 were calculated. It should be noted that pollutant load calculations were only carried out for conventional highway traffic along I-405. No attempt was made to estimate pollutant loads from the high-capacity transit (HCT) portion of this alternative. HCT would likely take the form of an electric light rail system. Although some pollutant loading could be expected from its right-of-way, it would be expected to be a small fraction of that of the conventional highway.

The calculated pollutant loadings along I-405 for Alternative 1 are virtually the same as those calculated for the No Action Alternative. Stormwater treatment would be implemented for new

impervious surfaces associated with each of the new projects proposed as part of this alternative. The overall operational impact of Alternative 1 upon surface water is judged to be below the threshold of significance.

Groundwater

Additional long-term traffic through sensitive areas would increase the potential for groundwater contamination via the spill and leak mechanisms. Additional impervious surface area passing through the WHPAs, APAs, SSAs, and CARAs would also increase the potential for contamination because more rainfall runoff may pick up contaminants and reach permeable soils if runoff water is not contained. The potential for Alternative 1 operational activities to adversely impact groundwater quality is therefore rated as moderate.

Alternative 1 is estimated to eliminate 215 acres of recharge area (including the No Action Alternative) versus the estimated loss of 104 acres of recharge for the No Action Alternative. Therefore, the potential for Alternative 1 operational activities to adversely impact groundwater recharge would be low. The incremental loss of 101 acres of recharge area is only 4 percent of the current total transportation infrastructure-related impervious surface in the I-405 corridor. Although some potential exists for operational activities to impact groundwater quality and quantity, the impacts that may occur are not substantial under normal operating conditions. However, in the traffic accident scenario, impacts to groundwater quality could be substantial.

### *3.5.4.3 Alternative 2: Mixed Mode with HCT/Transit Emphasis*

**Construction Impacts**

Surface Water

Under Alternative 2, six basins would have 10 or more projects constructed within their boundaries while an additional five basins would see between 5 and 10 projects. The Sammamish River Basin would experience the highest number of projects (16).

These projects would have the potential to temporarily degrade water quality during construction. Several of the stream basins have the potential to suffer serious, short-term water quality degradation due to a combination of their sloping nature and the relatively high number of projects proposed for construction (five or more). These would include East Lake Washington, the Lower Green, Cedar and Sammamish rivers and tributaries, and Springbrook, Swamp, Forbes, Juanita, South Kelsey, North, and Bear creeks. Wet weather construction within these basins could seriously degrade water quality. Substantial short-term impacts would be avoided by implementing water quality protection BMPs during construction.

Groundwater

Generally, Alternative 2 includes all of the elements of Alternative 1, with several additions. The areas of most potential impact remain Renton (primary) and Redmond (secondary), particularly in their respective downtown areas, where city water supply wells are located. With Alternative 2, the surface area of additional freeway and arterial lanes passing near these wells, within the WHPAs, and within Renton APA zones 1 and 2 would increase. A very rough estimate would be that the new impervious area in WHPAs, and APA zones in both cities is doubled, compared to Alternative 1. A third area of potential concern, the City of Kent, would be added with improvements to SR 167.

The number of public and private wells within one-quarter mile of the project would increase, primarily due to arterials in north Redmond, Newcastle, and Kent. The number of WHPAs affected would also increase from 8 to 13. New lanes on SR 167 and an associated arterial would cross three new WHPAs for Kent wells and the WHPA for Springbrook Springs. The number of other WHPAs would increase from two to three because the end of a new arterial would intersect the Maplewood WHPA.

The new impervious area crossing medium CARAs in Snohomish County would increase. New arterials would approximately double the crossing of high CARAs in downtown Redmond. In the southern portion of the study corridor, new lanes and arterial improvements would also approximately double the high CARA areas crossed. SR 167 would add a fourth CARA region with 6 miles of new lanes in a high CARA.

Approximately 50 percent of the Alternative 2 projects (those shown on the map) would cross potential recharge areas. Multiplying the total new impervious surface area of 820 acres including the No Action Alternative by 50 percent yields a value of 410 additional acres for the potential recharge area that may be lost as a result of the placement of new impervious surfaces.

### Operational Impacts

#### Surface Water

Alternative 2 would result in 820 acres (including the No Action Alternative) of new impervious surface within the study area. This would represent an increase of 0.6 percent in impervious area across the study area. The Springbrook Creek Basin would receive the most new impervious surface, 145 acres. Four other basins would receive more than 50 acres of impervious surface: East Lake Washington, Sammamish River, and South Kelsey and North creeks. Only the Duwamish River would experience less than 5 acres of new impervious surface. On a relative basis, South Kelsey Creek would experience the greatest impact, a 2 percent increase in impervious surface. The Lower Green River, and Forbes, North, Juanita, and Springbrook creeks would experience increases of one percent or greater of new impervious surface within their respective basins.

The improvements proposed under this alternative would result in an increase in runoff to local drainage systems and streams. The standard detention requirements for new projects would be generally sufficient to avoid causing or intensifying downstream drainage or flooding problems. However, runoff detention would not fully offset the changes in hydrology due to increased runoff volumes. The reduction in pervious area and its associated groundwater recharge would increase the frequency of moderate (return intervals of one year or less) stream flows and may result in a reduction in dry season base flows. This would be especially true for those basins mentioned above with a 1 percent or greater increase in impervious surface. Springbrook Creek already does not meet the water quality standard for temperature. Any substantial reduction in base flow could aggravate this situation.

Increases in COD, zinc, copper, total nitrogen, and total phosphorus, including approximately 145 tons per year of suspended solids, would be generated along the entire length of I-405 under Alternative 2, before treatment. There are a number of stormwater treatment facilities currently installed along I-405. Although their effectiveness in reducing overall highway pollutant loads has not been quantified regionally, actual pollutant loadings to the surface waters in the study area would be lower than the amounts calculated for this analysis. In summary, this alternative

would result in substantial increases in impervious surface area in three basins. This could result in reductions in the base flows of these streams. This could also aggravate the temperature and heavy metals problems documented in Springbrook Creek. This alternative is expected to have substantial adverse operational impacts to surface water resources based on the criteria identified in Section 3.5.2.1. However, with the mitigation measures proposed in Section 3.5.5, surface water impacts would be reduced to below the threshold of significance.

A comprehensive, basin-wide study is needed to address the serious water quality problems in the Springbrook Creek Basin. Such a study could determine the impact of future development, including transportation improvements, upon the hydrology and water quality of the stream. Measures that may be considered to address the water quality problems identified for Springbrook Creek Basin include groundwater recharge of treated stormwater, flow augmentation, re-establishment of riparian zone vegetation and associated shading, and stormwater treatment to reduce heavy metals. The study could identify stream improvements and stormwater management requirements necessary to achieve a net improvement in the temperature and heavy metal problems currently experienced by this stream.

Groundwater

The potential for Alternative 2 operational activities to adversely impact groundwater quality is rated moderate, but the relative extent of impacts is higher than for Alternative 1 (and the No Action Alternative) as a consequence of the approximate doubling of areas that cross WHPAs, APAs, CARAs, and the Cedar Valley sole-source aquifer.

Alternative 2 is estimated to eliminate 410 acres of recharge area (including the No Action Alternative) versus the estimated loss of 104 acres of recharge for the No Action Alternative. Therefore, the potential for Alternative 2 operational activities to adversely impact groundwater recharge would be moderate. The incremental loss of 306 acres of recharge area is only 12 percent of the current total transportation infrastructure related-impervious surface in the I-405 corridor. Although some potential exists for operational activities to impact groundwater quality and quantity, the impacts that may occur to groundwater quality and quantity are not substantial under normal operating conditions. However, in the traffic accident scenario, impacts to groundwater quality could be substantial.

#### *3.5.4.4 Alternative 3: Mixed Mode Emphasis*

**Construction Impacts**

Surface Water

Under Alternative 3, five basins would have 10 or more projects constructed within their boundaries, while an additional five basins would be affected by between 5 and 10 projects. North Creek would experience the highest number of projects (16). These projects would have the potential to temporarily degrade water quality during construction. Several of the stream basins have the potential to suffer serious, short-term water quality degradation due to a combination of their sloping nature and the relatively high number of projects proposed for construction (five or more). Basins most likely to experience serious short-term water quality degradation include East Lake Washington, the Sammamish and Cedar rivers and tributaries, and Springbrook, Swamp, Forbes, Juanita, South Kelsey, North, and Bear creeks. Mitigation measures identified in Section 3.5.5 would reduce impacts to a level that is not substantial. Wet-

weather construction within these basins could seriously degrade water quality. Substantial short-term impacts would be avoided by implementing water quality BMPs during construction.

Groundwater

Alternative 3 impacts are similar to those for Alternative 2, and the potential for construction impacts to adversely impact groundwater is rated moderate for impacts to groundwater quality and quantity. Although the rating of moderate for impacts from Alternative 3 is the same as the rating for impacts from Alternative 2, additional projects and additional surface area in sensitive areas does increase the relative potential for groundwater contamination during construction. The Alternative 3 relative extent of impacts to groundwater would be higher than that for Alternative 2 (and Alternative 1) as a consequence of the increase in areas that cross WHPAs, APAs, CARAs, and the Cedar Valley sole-source aquifer.

Although some potential exists for construction activities to impact groundwater quality and quantity, the potential impacts from implementation of Alternative 3 are not substantial.

**Operational Impacts**

Surface Water

Alternative 3 would result in 773 acres (including the No Action Alternative) of new impervious surface within the study area. This would represent an increase of 0.6 percent in impervious area across the study area. The Springbrook and North creek basins would receive the most new impervious surface, 111 acres. Three other basins would receive more than 50 acres of impervious surface: Sammamish River, South Kelsey Creek, and East Lake Washington Basin. The Duwamish River and Kelsey Creek would each receive less than 5 acres of new impervious surface. On a relative basis, South Kelsey Creek would experience the greatest impact, a 1.9 percent increase in impervious surface. The Lower Green River and North Creek would each experience an increase of about one percent of new impervious surface.

Increases would occur for COD, zinc, copper, total nitrogen, and total phosphorus including approximately 265 tons per year of additional suspended solids along the entire length of I-405, before treatment. Standard water quality treatment can substantially reduce contaminants, as described in the surface water impacts section for Alternative 2 above. In summary, this alternative would result in substantial increases in impervious surface area in two basins: South Kelsey and North creeks. This could result in reductions in the base flows of these streams. This alternative is expected to have substantial adverse impacts to surface water resources based on the criteria identified in Section 3.5.2.1. However, with the mitigation measures proposed, surface water impacts would be reduced to below the threshold of significance.

Groundwater

The potential for Alternative 3 operational activities to adversely impact groundwater quality is rated moderate, with the relative extent of impact approximately equal to that for Alternative 2.

Alternative 3 is estimated to eliminate 387 acres of recharge area (including the No Action Alternative) versus the estimated loss of 104 acres of recharge for the No Action Alternative. Therefore, the potential for Alternative 3 operational activities to adversely impact groundwater recharge would be moderate, with Alternative 3 having slightly less potential impacts than Alternative 2. The incremental loss of 283 acres of recharge area is only 11 percent of the current total transportation infrastructure-related impervious surface in the I-405 corridor.

### *3.5.4.5 Alternative 4: General Capacity Emphasis*

**Construction Impacts**

Surface Water

Under Alternative 4, six basins would have 10 or more projects constructed within their boundaries, while an additional four basins would see between 5 and 10 projects. The North Creek Basin would experience the highest number of projects (19), followed closely by the Sammamish River Basin.

These projects would have the potential to temporarily degrade water quality during construction. Several of the stream basins would potentially suffer serious short-term water quality degradation due to a combination of their sloping nature and the relatively high number of projects proposed for construction (five or more). These include East Lake Washington, the Cedar, Sammamish and Lower Green rivers and tributaries, and Springbrook, Swamp, Forbes, Juanita, South Kelsey, and North creeks.

Groundwater

Potential construction impacts to groundwater quality and quantity are similar to Alternative 3. Although there are differences between Alternatives 3 and 4 in the number and width of crossings of areas sensitive to groundwater contamination, the net effect is that the extent of construction impacts to groundwater for Alternative 4 would be approximately the same as for Alternative 3. The distribution of impacts shifts slightly, decreasing the extent of impacts in Redmond while increasing the extent of impacts in Renton and Kent.

Although some potential exists for construction activities to impact groundwater quality and quantity, the potential impacts from implementation of Alternative 4 would not be substantial. The potential for construction impacts to adversely impact groundwater is rated moderate.

**Operational Impacts**

Surface Water

Alternative 4 would result in 1,061 acres (including the No Action Alternative) of new impervious surface within the study area. This would represent an increase of 0.8 percent in impervious area across the study area. The South Kelsey and North creek basins would receive the most new impervious surface, 160 acres each. Three other basins would receive more than 100 acres of impervious surface: East Lake Washington, Sammamish River, and Springbrook Creek. The Swamp and Juanita creek basins would each receive between 50 and 100 acres of new impervious surface. The Duwamish River and Kelsey Creek Basin would each experience less than 5 acres of new impervious surface. South Kelsey Creek would experience the greatest impact, an approximately 3 percent increase in impervious surface. Forbes, Springbrook, Juanita, and North creeks, and the Lower Green River and East Lake Washington basins would each experience increases of between 1 and 2 percent of new impervious surface.

The standard detention requirements for new projects would be generally sufficient to avoid causing or intensifying downstream drainage or flooding problems from increases in runoff resulting from the proposed projects. However, runoff detention would not fully offset the changes in hydrology due to increased runoff volumes. The reduction in pervious area and its associated groundwater recharge would increase the frequency of moderate (return intervals of

one year or less) stream flows and may result in a reduction in dry season base flows. This would be especially true for those basins mentioned above with a 1 percent or greater increase in impervious surface. Springbrook Creek currently does not meet the water quality standard for temperature, and any substantial reduction in base flow could aggravate this situation.

Increases are expected in COD, zinc, copper, total nitrogen, and total phosphorous, including approximately 339 tons per year of additional suspended solids that would be generated along the entire length of I-405. Stormwater treatment would be implemented for new impervious surfaces associated with each of the new projects proposed as part of this alternative. Stormwater retrofit of existing road surfaces associated with these new projects should be evaluated and carried out wherever practicable. In particular, the lane additions proposed for all I-405 segments under Alternative 4 would present an opportunity to retrofit the entire length of I-405. It is a State goal to fully retrofit I-405 and other state highways in the study area by 2015. To the extent that this goal is achieved, quality benefits would result within portions of the study area.

In summary, this alternative would result in substantial increases in impervious surface area in seven basins. This could result in reductions in the base flows of these streams. This could also aggravate the temperature and heavy metals problems documented in Springbrook Creek. This alternative is expected to have substantial adverse operational impacts to surface water resources. However, with the mitigation measures proposed in Section 3.5.5, surface water impacts would be reduced to below the threshold of significance.

#### Groundwater

The potential for Alternative 4 operational activities to adversely impact groundwater quality is rated moderate. As is the case for construction impacts, the extent of impacts would be similar to those for Alternative 3, with a slightly shifted distribution.

The greatest distinction in potential impacts between Alternatives 3 and 4 is that the increased impervious surface area associated with Alternative 4 may increase the extent of operational impacts on groundwater quantity. Alternative 4 is estimated to eliminate 531 acres of recharge area (including the No Action Alternative) versus the estimated loss of 104 acres of recharge for the No Action Alternative. Therefore, the potential for Alternative 4 operational activities to adversely impact groundwater recharge would be moderate, with Alternative 4 having greater impacts than Alternative 3. The incremental loss of 427 acres of recharge area is only 17 percent of the current total transportation infrastructure-related impervious surface in the I-405 corridor. Although some potential exists for operational activities to impact groundwater quality and quantity, the impacts that may occur to groundwater quality and quantity would not be substantial under normal operating conditions. However, in the traffic accident scenario described above, impacts to groundwater quality could be substantial.

### *3.5.4.6 Preferred Alternative*

#### Construction Impacts

#### Surface Water

Under the Preferred Alternative, six basins would have ten or more projects constructed within their boundaries, while an additional seven basins would be affected by between five and ten projects. The North Creek Basin would experience the highest number of projects (21). These

projects would have the potential to temporarily degrade water quality during construction. Several stream basins have the potential to suffer serious short-term water quality degradation due to a combination of their sloping nature and the relatively high number of projects proposed for construction (five or more). Basins most likely to experience serious short-term water quality degradation include East Lake Washington, the Lower Green, Sammamish, and Cedar rivers and tributaries, and Springbrook, Swamp, Forbes, Juanita, South Kelsey, Coal, Forbes, North, May, and Bear creeks. Mitigation measures identified in Section 3.5.5 would reduce impacts to a level that is not substantial. Wet-weather construction within these basins could degrade water quality. Substantial short-term impacts could be avoided by implementing water quality BMPs during construction.

#### Groundwater

Impacts from the Preferred Alternative are similar to those for Alternative 3, and the potential for construction impacts to adversely impact groundwater is rated moderate for impacts to groundwater quality and quantity. Although the rating of moderate for impacts from the Preferred Alternative is the same as the Alternative 3 impacts rating, additional projects and additional surface area in sensitive areas does increase the relative potential for groundwater contamination during construction. The Preferred Alternative's relative extent of groundwater impacts would be higher than that for Alternative 3 as a consequence of the increase in areas that cross WHPAs, APAs, CARAs, and the Cedar Valley sole-source aquifer.

Although some potential exists for construction activities to impact groundwater quality and quantity, the potential impacts from implementation of the Preferred Alternative are not substantial.

### Operational Impacts

#### Surface Water

The Preferred Alternative would result in 974 acres (including the No Action Alternative) of new impervious surface within the study area. This would represent an increase of 0.7 percent in impervious area across the study area. The East Lake Washington Basin would receive the most new impervious surface: 154 acres. Four additional basins would receive more than 100 acres of new impervious surface: Sammamish River, South Kelsey, North, and Springbrook creeks, while Swamp Creek would receive between 50 and 100 acres. The Duwamish River and Kelsey Creek would experience less than five acres of new impervious surface. On a relative basis, South Kelsey Creek (Mercer Slough) would experience the greatest impact, an approximately 2 percent increase in impervious surface. The East Lake Washington, Lower Green River, and the North, Juanita, and Springbrook creek basins would each experience an increase of about 1 percent of new impervious surface.

Increases would occur for COD, zinc, copper, total nitrogen, and total phosphorus, including approximately 276 tons per year of additional suspended solids, along the entire length of I-405 before treatment. Standard water quality treatment can substantially reduce contaminants as described in the surface water impacts discussion for Alternative 2 in Section 3.5.4.3 above.

In summary, the Preferred Alternative would result in substantial increases in impervious surface area in six basins: East Lake Washington, Lower Green River, and the North, Juanita, Springbrook, and South Kelsey creeks. This could result in reductions in base flows of these streams. This alternative could also aggravate the temperature and heavy metals increase

documented in Springbrook Creek. Thus, the alternative is expected to have substantial adverse impacts to surface water resources based on criteria identified in Section 3.5.2.1. However, with the mitigation measures proposed, surface water impacts would be reduced to below the threshold of significance.

Groundwater

The potential for the Preferred Alternative operational activities to adversely impact groundwater quality is rated moderate, with the relative impact between Alternatives 3 and 4.

The Preferred Alternative is estimated to eliminate 487 acres of recharge area (including the No Action Alternative) versus the estimated loss of 104 acres of recharge for the No Action Alternative. Therefore, the potential for Preferred Alternative operational activities to adversely impact groundwater recharge would be moderate, with the Preferred Alternative having more potential impacts than Alternative 3 but less than Alternative 4. The incremental loss of 383 acres of recharge area is only 15 percent of the current total transportation infrastructure related impervious surface in the I-405 corridor.

## 3.5.5 Mitigation Measures

### *3.5.5.1 Surface Water*

The following possible mitigation measures generally apply to all of the alternatives.

- Best management practices such as installing fencing, landscaping, erosion matting, hydro mulching, soil imprinting, straw bales, detention/sediment trap basins, and vegetated fringes would be used as appropriate. WSDOT would use the most current criteria and standards to mitigate stormwater quantity and quality impacts of the selected alternative. These standards will be presented in a WSDOT stormwater or highway runoff manual that will be functionally equivalent to Ecology's stormwater manual. These revisions are expected to address specific issues related to fish, especially chinook salmon.
- Construction disturbance will be limited to the smallest area practical. In particular, natural, undisturbed areas would be disturbed a little as possible. Clearing activities will be staged such that construction areas are cleared no earlier than one week ahead of the start of construction where practical. If this is impractical, cleared areas will be immediately mulched, covered with plastic, or otherwise stabilized.
- For projects constructed within 300 feet of a lake or stream, or where concentrated construction site discharge may flow directly to surface waters, all site grading and initial stabilization could be scheduled to occur only during the dry season, May 1 through September 30. Where construction must occur within stream channels, such construction will occur "in the dry" whereby streamflow is temporarily diverted around the work site where practicable to prevent turbidity. If other construction activities occur during the wet season, such as subgrade or pavement installation, utilities placement, or curbs and sidewalks, a plan will be developed that:
  - Limits disturbed area activities to a maximum of 48 hours at any single location.
  - Has provisions for temporarily ceasing construction and quickly stabilizing a site when rainfall greater than one-half inch in a 12-hour period is measured at the site.

- Uses alternative means for treating construction site runoff such as spray application or overland flow across a vegetated surface, or use of coagulants in the sediment ponds. If coagulants are used, a nontoxic compound will be used, such as an ionic acrylamide.

Grassed road embankments and biofiltration swales will be utilized wherever practical to maximize treatment of road runoff. Where new stream crossings are proposed, the design will consider opportunities to minimize the number of crossings by measures such as co-siting together on-ramps and off-ramps.

Planning for all major road upgrade projects would consider the practicality of retrofitting existing impervious road surface areas for runoff detention and treatment. Where determined to be practicable, retrofit measures will be budgeted into the road upgrade project.

Wherever soil tests and site conditions demonstrate practicality, infiltration of treated stormwater would be utilized. Early in the design of specific projects, opportunities for regional treatment and detention would be explored with adjacent municipalities.

Any new road crossings of streams will be via a bridge spanning the 100-year floodplain unless a hydraulic analysis demonstrates that infringing abutments and/or bridge piers would not substantially change local high-water depths or velocities. Disturbed riparian areas within road right-of-way will be planted with native vegetation for a minimum width of 100 feet from each stream bank.

Opportunities to increase the "perviousness" of impacted stream basins may be explored in cooperation with local agencies; these include replacing low-intensity-use paved areas (parking lots, sidewalks, walking-bicycle paths, etc.) with porous pavement and/or underground retention systems. Deep tillage of playfields, parks, lawns, and other landscape surfaces with amended soils can also be effective in reducing runoff. Pervious portions of the study area may be treated with soil amendments, mulch, and vegetation to help absorb stormwater rather than discharge stormwater to surface waters. All stormwater management facilities will be located outside of stream, steep slope, and wetland buffer areas.

The I-405 Corridor Program will continue to work closely with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), the Washington State Department of Fish and Wildlife (WDFW), Ecology, the tribes, local municipalities, and basin stakeholders to develop a program of support for both local and regional stream enhancement projects. Projects that improve stream water quality and habitat, particularly those which would benefit Endangered Species Act-listed species such as bull trout and chinook salmon, would be identified and targeted for accelerated development supported by WSDOT. This support program would also incorporate the mitigation measures contained in the *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report* (DEA, 2001a) and the *I-405 Corridor Program Draft Wetlands Expertise Report* (DEA, 2001b). The reader is referred to the *I-405 Corridor Program Draft Fish and Watershed Summary Report* (DEA, 2001c) for further information on regional mitigation for the program. The mitigation measures in these reports are also presented in Section 3.6.5 (Wetlands) and Section 3.8.5 (Fish and Aquatic Habitat). Regional mitigation would be applied commensurate with residual impacts after direct mitigation measures are applied.

The following are additional specific mitigation measures.

**Alternatives 1 and 2.** The eastern extension of the HCT to Issaquah lies within the Lake Sammamish Basin. Projects constructed within this basin would require special stormwater treatment to reduce phosphorus.

**Alternative 2.** With regard to the Juanita, North, South Kelsey, and Forbes basins, stormwater will be infiltrated where practicable so that groundwater recharge is emphasized in these basins. In addition, WSDOT and the affected municipalities will consider implementing mitigation projects that benefit the hydrology and habitat of these streams as measures to compensate for potential reductions in stream base flow resulting from proposed road improvements.

A WRIA-wide approach to mitigation of the program hydrologic impacts would be considered as a means to more effectively address base flow impacts. WRIA-level mitigation will need to demonstrate a greater environmental benefit than on-site mitigation.

**Alternative 3.** Wherever soil tests and site conditions demonstrate the practicability, infiltration of treated stormwater will be used. This mitigation is particularly applicable to those basins which may otherwise experience depletion of base flows: South Kelsey and North creeks.

In addition, where practicable, WSDOT and the affected municipalities would commit to projects benefiting the hydrology and habitat of these streams as measures to compensate for potential reductions in stream base flow resulting from proposed road improvements.

In addition, a WRIA-wide approach to mitigation of the program hydrologic impacts will be considered as a means to more cost effectively address base flow impacts. WRIA-level mitigation will need to demonstrate a greater environmental benefit than on-site mitigation.

**Alternative 4.** A portion of Project R.CF.3 involves improvements to I-90 within the Lake Sammamish Basin. Projects constructed within this basin would require special stormwater treatment to reduce phosphorus.

Wherever soil tests and site conditions demonstrate the practicability, infiltration of treated stormwater will be utilized. This mitigation is particularly applicable to those basins which may otherwise experience depletion of base flows: Springbrook, South Kelsey, East Lake Washington, Forbes, Juanita, and North Creek. In addition, where practicable, WSDOT and the affected municipalities would commit to projects benefiting the hydrology and habitat of these streams as measures to compensate for potential reductions in stream base flow resulting from proposed road improvements. The comprehensive basin study for the Springbrook Creek Basin mentioned under Alternative 2 would also apply to Alternative 4.

In addition, a WRIA-wide approach to mitigation of the program hydrologic impacts will be considered as a means to address base flow impacts in a more ecologically beneficial and cost-effective manner.

**Preferred Alternative.** The mitigation measures presented for Alternative 4 would be applicable for the Preferred Alternative, except infiltration of treated stormwater will be emphasized where practicable in the following basins as a measure to mitigate depletion of base flow: East Lake Washington and Juanita, Springbrook, South Kelsey, and North creeks.

### *3.5.5.2 Groundwater*

#### Groundwater Quality

Mitigation measures to decrease the potential for groundwater contamination in the sensitive areas are based on minimizing the use of hazardous materials in the areas. During construction, the following mitigation measures will be implemented where practicable and appropriate to the project:

- Refueling and maintenance of construction vehicles will not occur within 100 feet of the edge of any sensitive areas. More restrictive measures may be required where ESA species would be impacted. Refueling will follow the Guidelines for Mobile Fueling of Vehicles and Heavy Equipment in Chapter III of the 2001 Ecology manual or functionally equivalent stormwater guidance.
- Hazardous materials will not be stored closer than 300 feet to any stream, wetland, or other sensitive area at the project site. Where hazardous materials must be temporarily stored at the project site, secondary containment will be provided.
- A project staging area will be located outside of the sensitive areas for vehicle fueling and storage of construction-related hazardous materials. The area will be designed to capture all runoff and/or spills.
- Runoff will be collected from construction areas and treated and/or discharged consistent with Ecology's Stormwater Manual (2001) or functionally equivalent stormwater guidance. Measures to protect Renton's Aquifer Protection Area from infiltration of project runoff will be implemented.
- A plan will be developed for hazardous material spill response.
- Fill will not contain hazardous materials or materials that could adversely affect upland and/or aquatic species due to leaching or bioaccumulation.

Measures for mitigation of operational impacts to groundwater quality are also based on preventing hazardous materials from reaching soil and infiltrating into groundwater. These measures could include:

- Runoff from construction areas will be collected and treated and/or discharged consistent with Ecology's Stormwater Manual (2001) or functionally equivalent stormwater guidance. Measures to protect Renton's Aquifer Protection Area will be implemented.
- Spill prevention, control, and countermeasure plans will be developed and will include local, state, and Federal emergency contact information.
- Barriers will be placed at the sides of roads within WHPAs, SSAs, and high CARAs to prevent spills from reaching soils.

The last two measures may be applied specifically to address the substantial potential for groundwater contamination that could occur under the rare traffic accident chemical spill scenario.

#### Groundwater Quantity

To mitigate the potential decrease in groundwater recharge in CARAs and other potential recharge areas during construction, stormwater that might have been collected and conveyed to

areas outside the CARAs can be re-infiltrated. In this scenario, the mitigation measures will include some form of treatment to ensure that groundwater quality is not adversely affected, such as the use of bioswales or infiltration ponds. Other measures for mitigating long-term loss of recharge to aquifers could include:

- Decreasing slopes of areas not covered with impervious surfaces.
- Planting vegetation in cleared areas.
- Providing adjacent infiltration areas where large areas of impervious surfaces are unavoidable; in other words, interspersing pervious areas among the impervious areas to allow recharge via infiltration of rainwater. Runoff from construction areas will be collected and treated and/or discharged consistent with Ecology's Stormwater Manual (2001) or functionally equivalent stormwater guidance. Measures to protect Renton's Aquifer Protection Area from infiltration of project runoff will be implemented.

Additional mitigation measures may be achieved by following the design guidelines in the local sensitive area ordinances (such as measures to prevent erosion).

To mitigate the depletion of groundwater supplies via construction dewatering or pump testing, the groundwater that is removed may be re-infiltrated, provided programs are in place to test for and/or treat to the groundwater to remove hazardous materials that may have come in contact with the groundwater.