4.9 Water Resources

4.9.1 Introduction to Resources and Regulatory Requirements

This section describes the affected water resources and potential hydrologic, flooding, and water quality impacts associated with the East Link Project alternatives. The study area for water resources is the stream basins within which the project would be constructed, shown in Exhibit 4.9-1.

The following laws, statutes, local ordinances, and guidelines address hydrology, water quality, and/or flooding issues:

- National Pollutant Discharge Elimination System (NPDES) Permit Regulations
- Presidential Executive Orders 11988 and 11990
- Washington State Water Quality Standards
- Ecology *Stormwater Management Manual for Western Washington* (Ecology, 2005)
- WSDOT *Highway Runoff Manual* (WSDOT, 2006)
- Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA requirements
- The National Flood Insurance Protection Act
- The Flood Disaster Protection Act
- Sections 401, 402, and 404 of the Clean Water Act (CWA)
- Section 10 of the Rivers and Harbors Act
- City floodplain and drainage regulations
- City and county sensitive area ordinances

Impacts on stream habitat and stream buffers are addressed in Section 4.8, Ecosystem Resources.

4.9.2 Affected Environment

The basins within the study area (Exhibit 4.9-1) have a total combined area of 21,500 acres. They drain from a high elevation of roughly 500 feet to Lake Washington at an elevation of 21 feet (King County, 2007a; Horizon Systems Corporation [Horizon], 2007). Most of the basin areas crossed by the alternatives are urbanized, with impervious surface cover ranging from approximately 30 percent to a high of nearly 70 percent around Downtown Bellevue (City of Bellevue, 2002). Notable features in the study area include the heavily developed corridors of I-90, I-405, and SR 520; Seattle; Downtown Bellevue; Downtown Redmond; and surrounding suburban development.

The affected environment is described in the following subsections, addressing surface waters, stormwater management, floodplains, wellhead protection zones (WPZs), and maintenance-facility surroundings. Project segments are addressed separately as applicable.

4.9.2.1 Surface Waters

Each of the water bodies in the study area is designated by Ecology for the following uses: core summer salmonid habitat; extraordinary primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values (Ecology, 2004). These uses are used to define the Ecology water quality standards that must be met for each water body. Table 4.9-1 summarizes the parameters for Ecology's 303(d) water quality standards that have been exceeded within the water bodies in the study area. See insert on page 4.9-3 for an explanation of 303(d) section of the Clean Water Act.

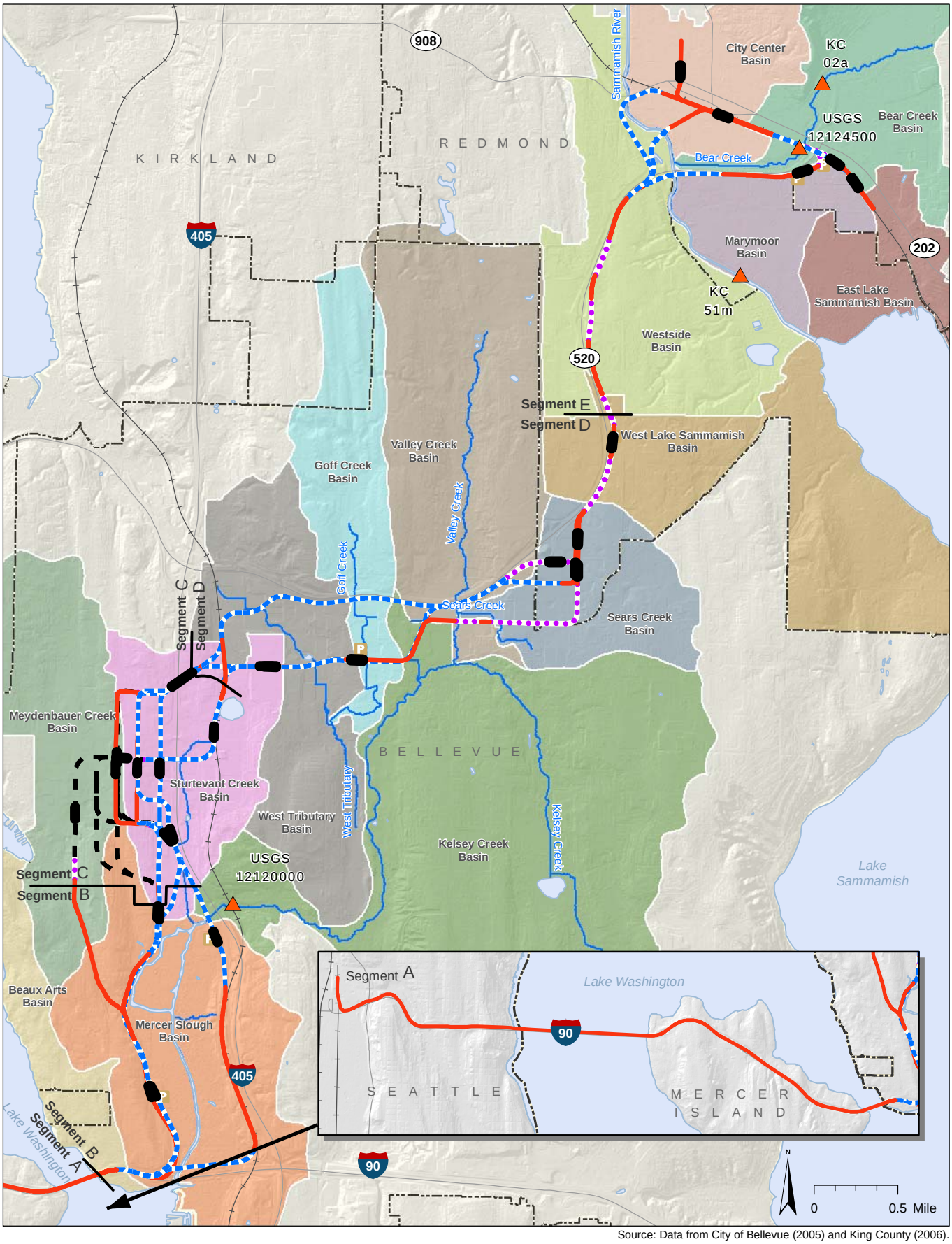
TABLE 4.9-1
303(d) Designated Use Violations (2004)

Water Body Basin	Fecal Coliform	Dissolved Oxygen	Temperature	Total PCBs[a]
Lake Washington	✔			✔
Beaux Arts				
Mercer Slough	✔		✔	
Meydenbauer Creek				
Sturtevant Creek				
Kelsey Creek	✔	✔	✔	
West Tributary				
Goff Creek				
Valley Creek				
Sears Creek	✔	✔		
Sammamish River	✔	✔	✔	
Bear Creek	✔ [b]	✔ [b]	✔ [b]	

[a] PCB = polychlorinated biphenyl

[b] A total maximum daily load (TMDL) is under development for this parameter on this water body.

Source: Ecology, 2004.



Source: Data from City of Bellevue (2005) and King County (2006).

Stream Flow Gage
Stream
Drainage Subbasin Affected by Route Alternatives
At-Grade Route
Elevated Route
Retained-Cut Route
Tunnel Route
Proposed Station
New and/or Expanded Park-and-Ride Lot

Exhibit 4.9-1
Water Resources Overview Segments A,B,C,D, and E
East Link Project

Segment A

Lake Washington is the dominant water resource in Segment A. It is the second largest lake in Washington State and lies between Seattle and Bellevue, where it would be crossed by Segment A. Most of the study area drains to this lake. The lake is 1 to 3 miles wide and extends 18 miles from Renton to Kenmore. Its two largest tributaries are the Cedar and Sammamish rivers; the Cedar River lies within the study area and is discussed below. The lake is a major recreational feature in the region, with heavy use for swimming, fishing, and boating. Although algae blooms can occur, the lake generally has good water clarity. Various locations throughout the lake have been placed on the 2004 Ecology 303(d) list of impaired water bodies for violations of standards for nitrogen, fecal coliform, and total polychlorinated biphenyl (PCB) (Ecology, 2004).

What is the Ecology 303(d) List?

The federal Clean Water Act (CWA), adopted in 1972, requires states to restore their waters to be "fishable and swimmable." The CWA established a process to identify and clean up polluted waters. Every 2 years, all states are required to prepare a list of water bodies that do not meet water quality standards.

Ecology has prepared a preliminary assessment of water quality in Washington. The assessed waters are listed in categories that describe the status of water quality. For those waters that are in the polluted category, beneficial uses—such as drinking, recreation, aquatic habitat, and industrial use—are impaired by pollution.

For 303(d)-listed water bodies, total maximum daily loads (TMDLs) are developed by Ecology for the pollutants that exceed water quality standards as a means for ultimately attaining the standards.

Segment B

Mercer Slough covers 1,330 acres and receives inflow from Kelsey Creek and Sturtevant Creek. The southern portion of the slough flows through the protected Mercer Slough Nature Park, underneath I-90, and into Lake Washington. In the northern part of the basin, Mercer Slough is separated into an east and a west branch. The west branch is formed by the confluence of Sturtevant and Kelsey creeks. The gradient is gradual, creating sluggish flow in these branches. Mercer Slough is at the same elevation as Lake Washington and has no perceptible flow. Approximately 35 percent of the basin area is covered by impervious surface, indicating a moderate level of basin development (City of Bellevue, 2002). The primary functions of Lower Mercer Slough are to provide a migration corridor for salmon and trout and to support one of the largest wetlands within the area. The water body is listed on the 2004 Ecology 303(d) list of impaired water bodies with violations of standards for temperature and fecal coliform (Ecology, 2004).

Segments C and D

Sturtevant Creek. Sturtevant Creek originates at Lake Bellevue and drains southward from an area of just over 770 acres into Mercer Slough (City of Bellevue, 2002). I-405 runs parallel to the creek, crossing it midway between Lake Bellevue and Mercer Slough. The creek is surrounded on both sides by heavy commercial and high traffic use, making the basin approximately 65 percent impervious. The entire basin falls within the City of Bellevue. Lake Bellevue, located in the upper portion of the basin, is completely surrounded by commercial development and is home to nonnative goldfish.

Kelsey Creek. Kelsey Creek drains an area of over 9,200 acres into Mercer Slough (Horizon, 2007). Of this area, subbasins totaling 6,700 acres lie within the study area. Smaller upstream tributaries include (from east to west) Sears Creek, Valley Creek, Goff Creek and West Tributary Kelsey Creek. Kelsey Creek flows north through Larson Lake and loops around to the west and south, receiving the flows of the above-mentioned tributaries along the way. Land use within the associated basins is primarily light to medium residential. An exception is the medium- to high-density commercial development along the southern portion of SR 520, which crosses Goff and Valley creeks. Directly to the west of the West Tributary Kelsey Creek headwaters is the SR 520 and I-405 interchange. These uses contribute to an overall impervious surface coverage of approximately 40 percent of the basin (City of Bellevue, 2002). The U.S. Geological Survey (USGS) has recorded flows within Kelsey Creek ranging from 2.4 to 412 cubic feet per second (cfs) near its confluence with Mercer Slough. The water body is also listed on the 2004 Ecology 303(d) list of impaired water bodies with violations of standards for temperature, fecal coliform, and dissolved oxygen (Ecology, 2004).

Segment E

Sammamish River. The Sammamish River is the largest tributary flowing to Lake Washington, draining over 150,000 acres (Horizon, 2007). The river begins at the outlet from Lake Sammamish, then flows north and west for 15 miles through Redmond, Woodinville, Bothell, and Kenmore. Decades ago the river channel was dredged and straightened. Along its route, it collects flow from Bear Creek, Little Bear Creek, North Creek, and Swamp Creek. Land use within the Sammamish basin varies from urban commercial and residential to recreational, agricultural, and open space. Multiple subbasins of the Sammamish River watershed lie within the Segment E study area, totaling 6,900 acres. The study area

includes the first 2 miles of the Sammamish River as it flows through Marymoor Park, a large regional park, and past Downtown Redmond. Study area basins draining to the river include East Lake Sammamish, Westside, Marymoor, and City Center (Exhibit 4.9-1). Flow records at a gage midway down the river measured flows ranging from 25 to 2,830 cfs. The Sammamish River has been added to Ecology's 2004 303(d) list of impaired water bodies in Washington because water quality in the river exceeds standards for temperature, fecal coliform, and dissolved oxygen (Ecology, 2004).

Bear Creek. The headwaters of Bear Creek are located in southern Snohomish County. The creek drains a total of 31,000 acres and flows into the Sammamish River, just south of Downtown Redmond (Horizon, 2007). Major tributaries include tributary flows from Evans Creek, Cottage Lake Creek, and Seidel Creek.

The lower portion of Bear Creek lies within the study area and has a basin area of 2,800 acres. Recorded flows along the lower portion of Bear Creek have ranged from 16 to 1,040 cfs. Bear Creek is on Ecology's 303(d) because it exceeds the allowable water quality standards for dissolved oxygen, fecal coliform, and temperature (Ecology, 2004). In response to these water quality issues, Ecology has begun a total maximum daily load (TMDL) study. The Bear-Evans creek system is recognized as one of the top six natural resource basins in King County in the Waterways 2000 program (King County, 1998).

4.9.2.2 Stormwater Management

Segment A lies entirely within the I-90 right-of–way. For much of the length of Segment A in Seattle, runoff flows to a combined pipe system that receives both stormwater runoff and sanitary sewage. This combined flow is conveyed to the West Point Treatment Plant where the water is treated and discharged to Puget Sound. For the portion of I-90 crossing Mercer Island, the highway runoff is conveyed within the WSDOT-owned pipe system and discharged to Lake Washington. Some stormwater treatment is provided within settling vaults.

The remaining project segments lie within the cities of Bellevue and Redmond. These cities operate separated stormwater systems. These systems only collect and convey stormwater, not sanitary sewage. These systems typically discharge to the local streams. Urbanization within these cities has changed many of the land uses, from forested areas to urban development. Higher peak flows that are caused by impervious surface prevent infiltration from occurring and result in channel scour and degradation of stream habitat. To reduce the high flows that would otherwise occur within the streams, both cities operate a system of regional detention ponds. Runoff from developments constructed less than 15 to 20 years ago generally receives treatment and detention prior to discharge into the city stormwater systems. Each city operates a regional stormwater system within its downtown area. The regional system has the advantage of allowing new development to discharge stormwater to them without having to provide stormwater facilities for each new development. For convenience, these are referred to as the Bellevue or Redmond Stormwater Service Area in this report.

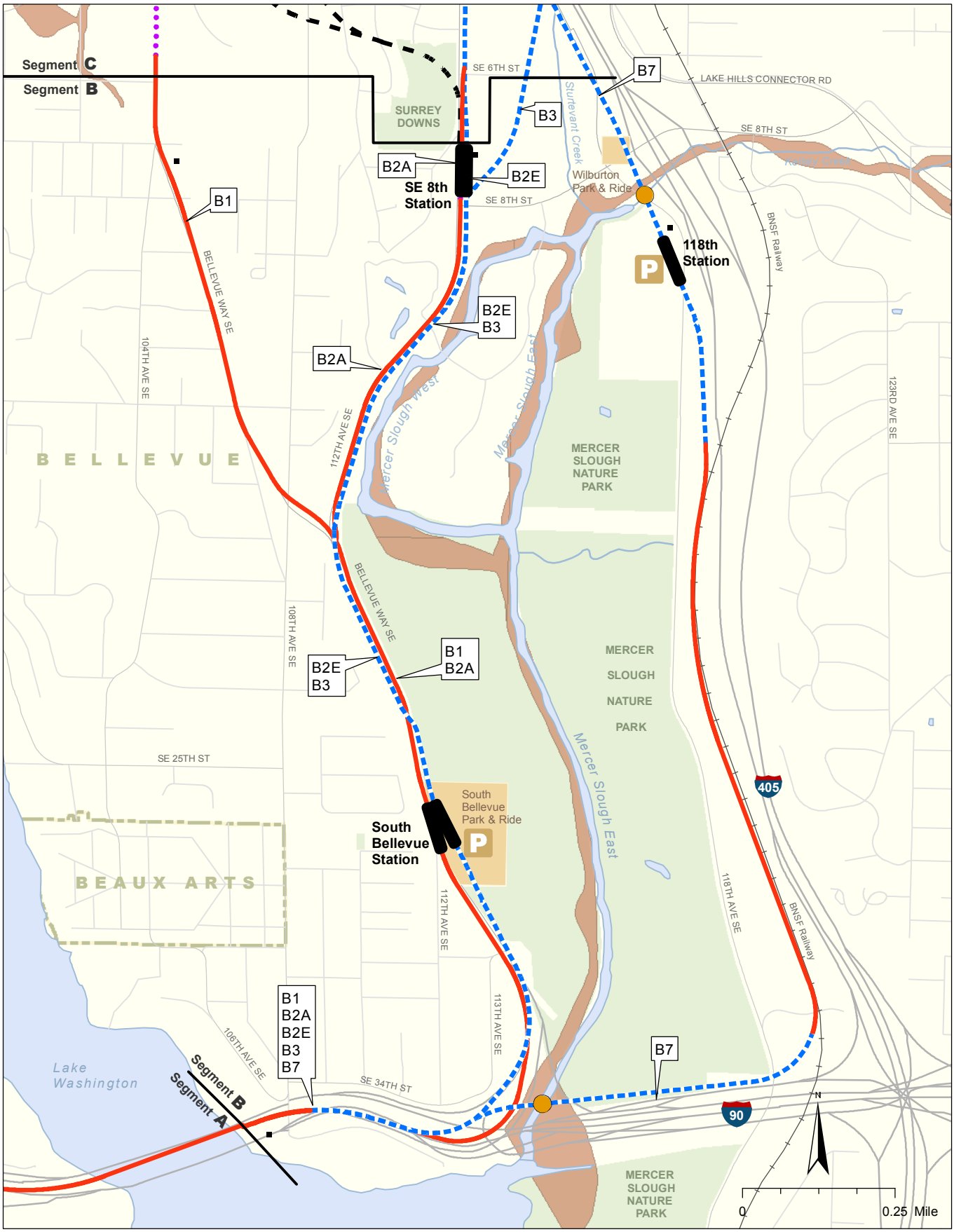
The cities in the study area have active stormwater management regulations and programs. Ecology provides guidelines for stormwater management in its *Stormwater Management Manual for Western Washington* (Ecology, 2005), also known as the Ecology Manual. Bellevue and Redmond generally comply with the Ecology Manual. The City of Seattle is updating its stormwater code to more closely comply with the Ecology Manual. The revisions are scheduled to be completed soon and implemented in 2008 (Johnson, 2007).

4.9.2.3 Floodplains

Federal Emergency Management Agency (FEMA) 100-year floodplains, as mapped by FEMA, are shown in Exhibits 4.9-2 through 4.9-5. In general, 100-year floodplains that are crossed by the project are less than 200 feet wide; however, wider floodplains lie along the lower reaches of Bear Creek and along the Sammamish River. The Sammamish River valley is broad and gently sloping, with a 100-year floodplain that is nearly 1 mile wide in places. Some of the smaller creeks and tributaries, including Goff Creek, Sears Creek, and Sturtevant Creek, do not have formally delineated floodplains. Occasional flooding has been reported on Valley Creek north of the intersection of NE 20th Street and 140th Avenue NE (Watson, 2007).

4.9.2.4 Groundwater

With the exception of the City of Redmond (see below), there is limited use of groundwater in the study area. Groundwater levels vary considerably throughout the project vicinity. Glacial till underlies much of the area at shallow depth. Water infiltrates slowly through this material. It is not uncommon during the rainy season for perched groundwater to pond at the surface. During the drier summer months, groundwater plays a critical role in providing base flow to the streams in the area.



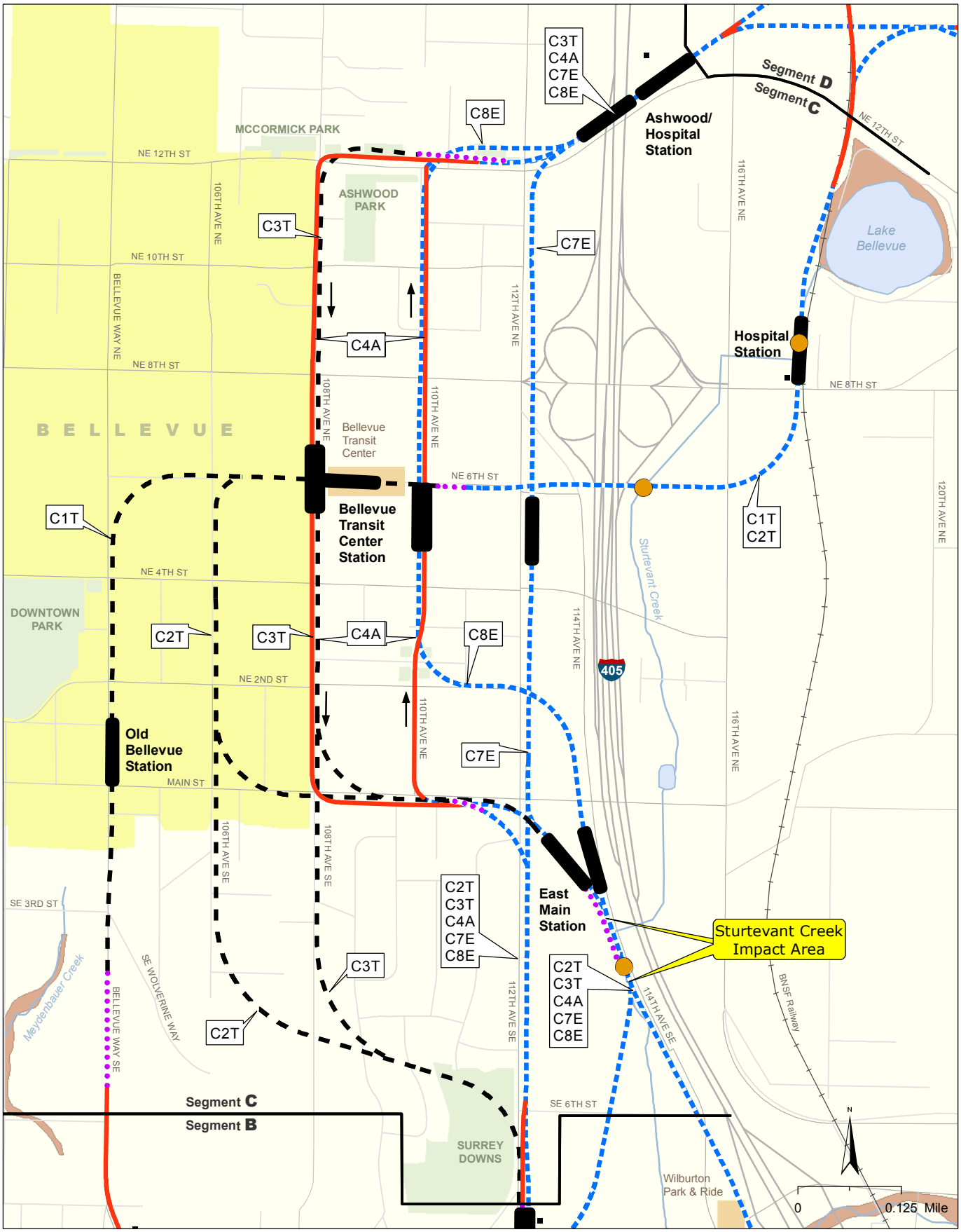
Source: Data from CH2M HILL (2007), Federal Emergency Management Agency (1995), City of Bellevue (2005), and King County (2006).

Stream Crossing
100-Year Floodway
100-Year Floodplain

At-Grade Route
Elevated Route
Retained-Cut Route
Tunnel Route

Traction Power Substation
Proposed Station
New and/or Expanded Park-and-Ride Lot

Exhibit 4.9-2
Water Resources
Segment B
East Link Project



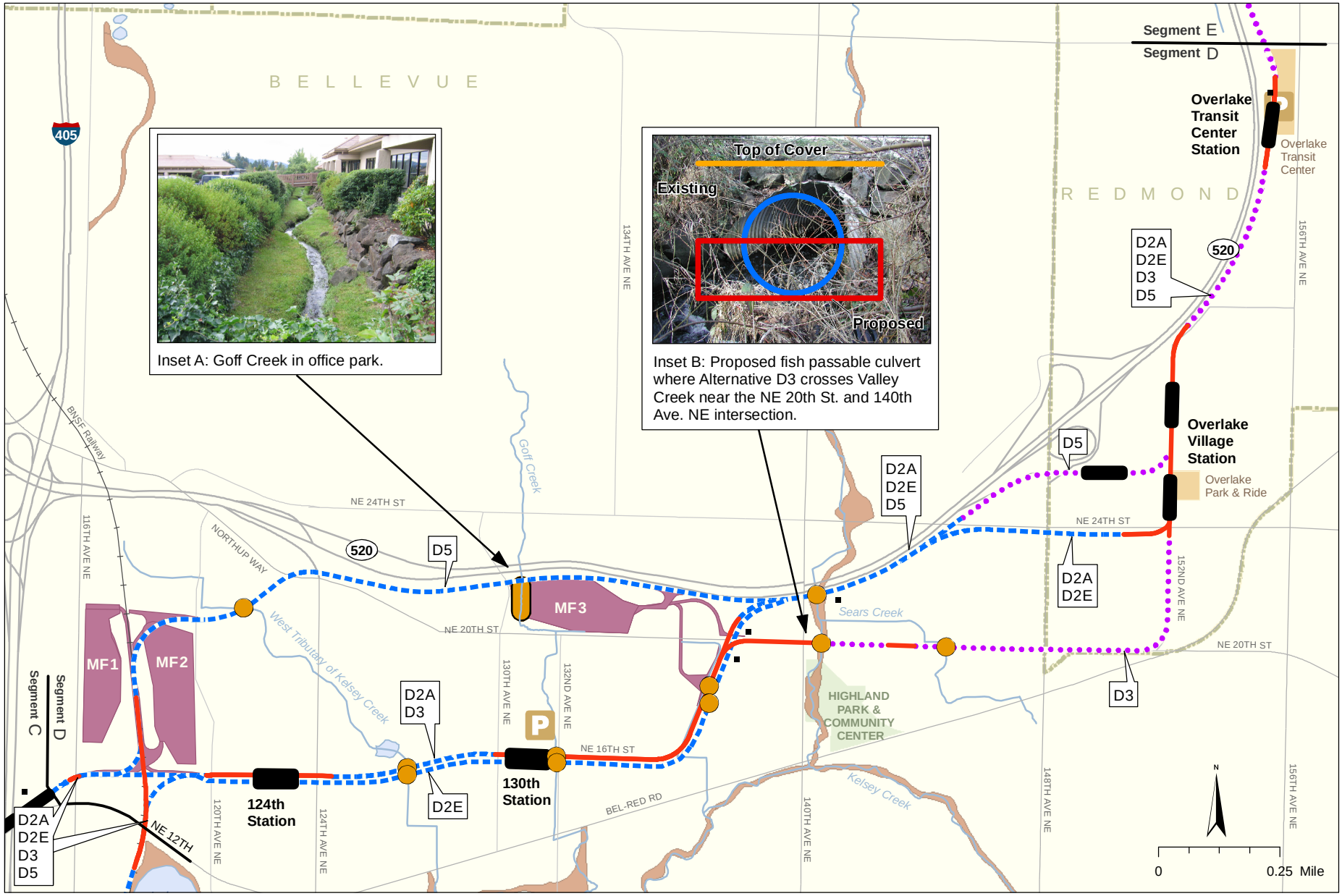
Source: Data from Federal Emergency Management Agency (1995), CH2M HILL (2007), City of Bellevue (2005), and King County (2006).

Stream Crossing
100-Year Floodway
100-Year Floodplain
Bellevue Stormwater Service Area

At-Grade Route
Elevated Route
Retained-Cut Route
Tunnel Route

Traction Power Substation
Proposed Station
P New and/or Expanded Park-and-Ride Lot

Exhibit 4.9-3
Water Resources
Segment C
East Link Project



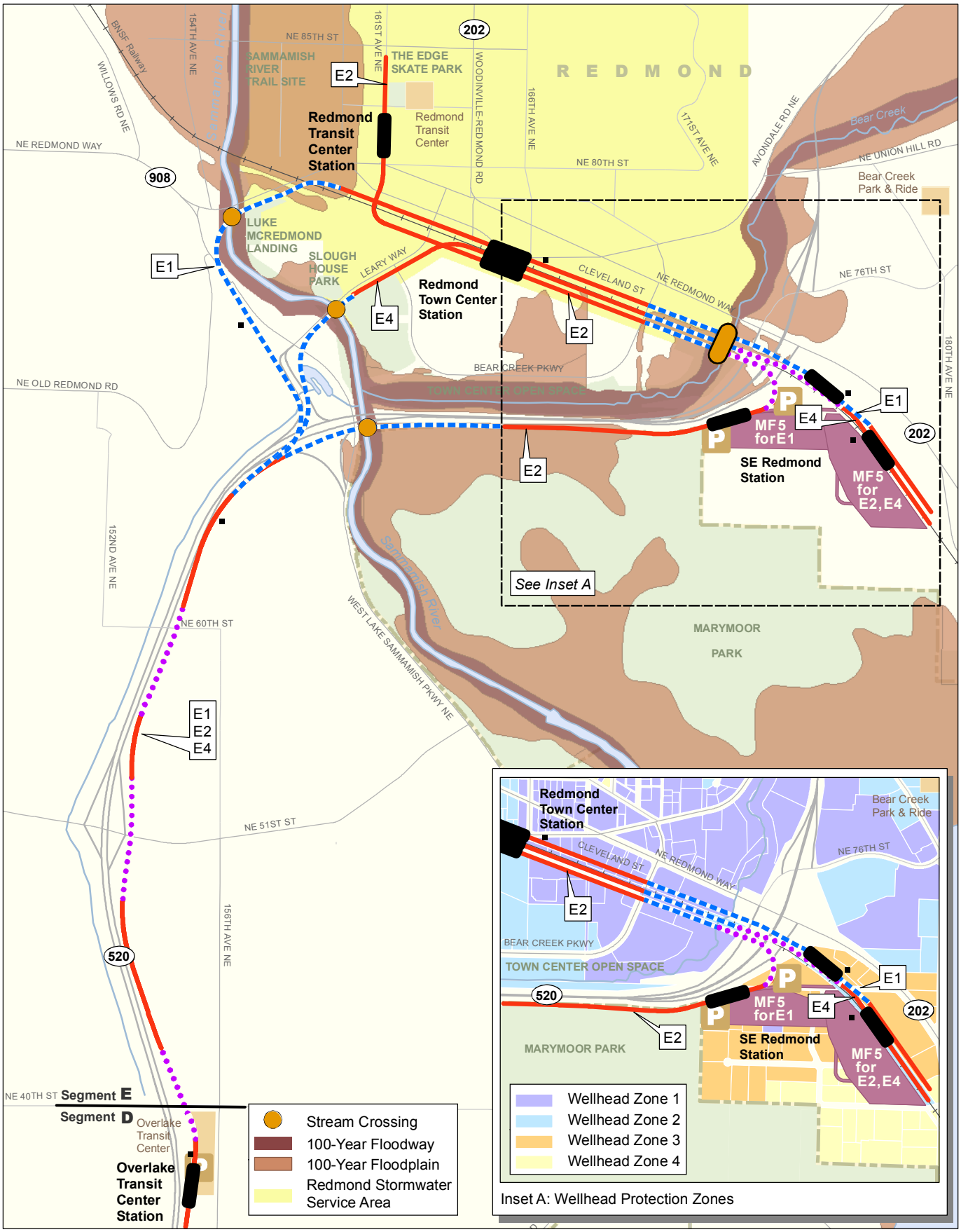
Source: Data from CH2M HILL (2007), Federal Emergency Management Agency (1995), City of Bellevue (2005), City of Redmond (2005), and King County (2006).

Stream Crossing
100-Year Floodway
100-Year Floodplain

At-Grade Route
Elevated Route
Retained-Cut Route
Tunnel Route

Traction Power Substation
Proposed Station
Maintenance Facility and Access Track
New and/or Expanded Park-and-Ride Lot

Exhibit 4.9-4
Water Resources
Segment D
East Link Project



Source: Data from CH2M HILL (2007), Federal Emergency Management Agency (1995), Parametrix (2007), City of Redmond (2005) and King County (2006).

- At-Grade Route
- Elevated Route
- Retained-Cut Route
- Tunnel Route
- Traction Power Substation
- Proposed Station
- Maintenance Facility and Access Track
- New and/or Expanded Park-and-Ride Lot

N

0 0.25 Mile

Exhibit 4.9-5
Water Resources
Segment E
East Link Project

The Sammamish Valley supports a productive aquifer that is used by the City of Redmond as a source of drinking water from several municipal wells. The closest municipal well is less than a quarter mile away in Anderson Park, on the north side of SR 202. Thus, the area south of Downtown Redmond is designated as a well protection zone (WPZ) (see Exhibit 4.9-5). Such areas serve as recharge areas surrounding domestic wells. The City of Redmond has a Wellhead Protection Ordinance (Chapter 13.07) that specifies measures to minimize the threat of groundwater contamination. Four zones are defined that require increasingly stringent controls and reporting of industrial and related activities that handle or store hazardous materials. This issue is discussed further in Section 4.9.3.2, Impacts During Operation, under the heading Groundwater.

4.9.2.5 Maintenance Facility Surroundings

Each of the alternative maintenance facilities would be located in an area that is mostly impervious surface composed of office, commercial, warehouse and light industrial facilities. Each of the areas is generally well-served with stormwater infrastructure. There are no surface water bodies close to the 116th Maintenance Facility (MF1) or the SE Redmond Maintenance Facility (MF5). A wetland lies along the northern edge of the BNSF Maintenance Facility (MF2). Goff Creek flows through the western portion of the SR 520 Maintenance Facility (MF3). A portion of MF5 lies within the City of Redmond's WPZ 3. Redmond's WPZs are discussed in Section 4.9.2.4 above.

4.9.3 Environmental Impacts

As part of the conceptual engineering done for the East Link Project, a design was developed for the major stormwater detention and treatment facilities necessary for the proposed alternatives. In general, a conservative approach was taken when developing drainage concepts. Sound Transit applied the Western Washington Hydrology Model, developed by Ecology, to develop project hydrology and to determine sizing of the facilities. Detention facilities were designed to achieve post-project stormwater flows equivalent to forested conditions, as required by Ecology. Further information on project stormwater can be found in Section 4.9.3.2, Impacts During Operation, under the heading Stormwater Treatment and Detention.

4.9.3.1 No Build Alternative

Under this alternative, some redevelopment and new development in the study area would still occur, with the potential to increase impervious surface and affect surface waters or groundwater.

For those sections of road that would have been relocated by the project, stormwater detention and treatment would likely be delayed until future redevelopment occurred. Higher vehicle miles traveled is also expected under the No Build Alternative. This could result in more traffic, which can increase turbidity and sediment in streams and degrade water quality.

As documented in Section 4.2, Land Use, a consequence of the No Build Alternative would be that a lower density of residential and commercial development would occur at key points along the proposed light rail corridor because the higher-density, transit-oriented development planned around light rail may not occur. By not building the East Link Project, some portion of this development would likely occur on the urban fringe rather than in the existing urban centers that would by served by the project. This type of development in undeveloped areas would result in an increase in impervious area and an associated increase in stormwater runoff in the urban fringe. Stormwater facilities associated with urban fringe development would reduce potential impacts on local streams; however, during the summer months they could reduce stream flows and degrade water quality.

4.9.3.2 Impacts During Operation

Impacts of the build alternatives are presented by segment and address the following impacts on water resources: impervious area, stormwater, streams and floodplains, and groundwater.

Impervious Area

Impacts Common to All Build Alternatives. Overall, the project would increase the amount of impervious surface area by approximately 14 to 31 acres depending on the alternatives selected. Impervious surfaces can increase stormwater runoff rates, volumes, and pollutant loads. These, in turn, can cause higher flows and degraded water quality in storm sewers and streams. New impervious areas from the project would include tracks and guideways, stations, park-and-ride lots, maintenance facilities, and roads. Ballasted (i.e., gravel) track sections were counted as impervious areas because of the high compaction and low permeability of the subsoils underlying the tracks. Relocated roads to accommodate the project were also counted as project-associated impervious area because the new and replaced pavement would require stormwater treatment and detention. For those cases where elevated track would overlay a relocated road, the underlying impervious area of the road was not counted in the impervious area numbers (to avoid

double-counting). Existing impervious area was obtained from a GIS map of 2000 impervious areas developed by King County (King County, 2004). This represents the best impervious area data available for the study area.

Table 4.9-2 provides a summary of total existing and proposed impervious area within the project limits for each project alternative. The project limits include the right-of-way for the rail corridor, relocated streets, the maintenance facility, and new project park-and-ride lots. A further breakdown by both project alternative and basin is provided in Appendix F4.9. In general, elevated alternatives would result in less new impervious area than at-grade alternatives because they would be typically narrower and require less road relocation. Tunnel alternatives would add small amounts of impervious area.

Pollutant-Generating Impervious Surface

Impervious surfaces are considered a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to vehicular use; industrial activities (as defined in the Ecology Manual); and storage of erodible or leachable materials, wastes, or chemicals; and which receive direct rainfall or the run-on or blow-in of rainfall.

Project pollutant-generating impervious surface (PGIS) is composed primarily of roads parallel to the project route that would need to be reconstructed to accommodate the light rail tracks and road intersections with the at-grade rails. PGIS is also composed of access roads and parking areas at the project park-and-ride lots and the access roads, parking surfaces, and equipment maintenance and fuel/chemical transfer areas at the maintenance facilities. Project trackways, guideways, and stations are considered non-PGIS.

There are several important factors that influence project PGIS. Project park-and-ride lots have large parking surfaces and each would contribute between 4 and 5 acres of PGIS. Elevated alternatives have little to no need for road reconstruction and thus would have relatively low PGIS values. This is exemplified by the 112th NE Elevated (C7E) and the 110th NE Elevated (C8E) alternatives (Table 4.9-2), which have zero PGIS. Note that the I-90 Alternative (A1), while not elevated, would also result in virtually no PGIS because The I-90 Alternative (A1) consists of either stations or track (non-PGIS) and requires almost no road relocation. In contrast, at-grade alternatives within urban settings frequently require the relocation of multiple lanes of roadway parallel to the alternative, which would result in a relatively large PGIS and are exemplified by the Bellevue Way (B1), 112th SE At-Grade (B2A), and NE 20th (D3) alternatives. Stormwater runoff from project-related PGIS would receive water quality treatment as discussed in the section below titled Stormwater Treatment and Detention.

Potential Impacts by Alternative. Segment A and the portion of Segment B within the Beaux Arts basin would be constructed completely within the existing I-90 corridor, resulting in no new impervious area. In addition, the I-90 center roadway east of Rainier Avenue S and exclusive light rail use of the D2 roadway would change the ground surface from PGIS to non-PGIS. At 6.2 acres, the Bellevue Way Alternative (B1) would add the most impervious area of the Segment B alternatives. The 112th SE Elevated Alternative (B2E) would add the least amount of impervious area (3.7 acres).

The only at-grade Segment C alternative, the Couplet Alternative (C4A), would add the most impervious area (2.7 acres) of the Segment C alternatives. The Bellevue Way Tunnel (C1T), 106th NE Tunnel (C2T), and 108th NE Tunnel (C3T) alternatives would add the least (0.5 to 0.7 acre).

Even though it has the least impervious area among the Segment D alternatives, the SR 520 Alternative (D5) would result in the largest increase in impervious area (12.5 acres) of all the alternatives because it would be routed through the largely undeveloped portion of the corridor immediately south of SR 520. The other three Segment D alternatives would result in a similar increase in impervious area of approximately 9 acres.

The Redmond Way Alternative (E1) would have the smallest impervious area increase (4.2 acres), and the Marymoor Alternative (E2) would have the largest increase in impervious area (5.8 acres).

The 116th Maintenance Facility (MF1) and the SE Redmond Maintenance Facility (MF4) would result in a local increase in impervious area. Because of the highly developed nature of the areas proposed for the BNSF Maintenance Facility (MF2) and the SR 520 Maintenance Facility (MF3), selection of either facility would result in a net local decrease in impervious area. This is because these two maintenance facilities would result in more landscaped, pervious area than currently exists in the respective areas. Impervious surfaces at maintenance facilities would be PGIS except for sidewalks, roofs, and tracks that are not crossed by motor vehicles.

TABLE 4.9-2
Existing and Proposed Impervious Areas by Project Alternative

Segment/Alternative		Total Existing Impervious Area (acres)	Total Proposed Impervious Area (acres)	Total New Impervious Area (acres)	Total % Impervious Area Increase	Total Project Pollutant-Generating Impervious Surface (existing and new) (acres)[d]
A, Interstate 90	A1, I-90	27.8	27.8	0.0	0%	0.0
B, South Bellevue	B1, Bellevue Way	21.5	27.7	6.2	29%	15.4
	B2A, 112th SE At-Grade	17.1	22.6	5.5	32%	10.8
	B2E, 112th SE Elevated	10.8	14.5	3.7	34%	5.6
	B3, 112th SE Bypass	15.0	20.0	5.0	33%	9.4
	B7, BNSF	13.4	17.3	3.9	29%	2.9
C, Downtown Bellevue	C1T, Bellevue Way Tunnel	9.7	10.2	0.5	5%	5.4
	C2T, 106th NE Tunnel [a]	6.5	7.0	0.5	8%	3.7
	C3T, 108th NE Tunnel [a]	2.4	3.2	0.8	33%	1.6
	C4A, Couplet [a]	11.9	14.6	2.7	23%	4.0
	C7E, 112th NE Elevated [b]	4.2	5.7	1.5	36%	0
	C8E, 110th NE Elevated	4.9	6.8	1.9	39%	0
D, Bel-Red/Overlake	D2A, NE 16th At-Grade [c]	17.6	26.8	9.2	52%	7.9
	D2E, NE 16th Elevated [c]	14.5	23.4	8.9	61%	6.0
	D3, NE 20th [c]	29.6	39.4	9.8	33%	16.5
	D5, SR 520 [c]	8.5	21.0	12.5	147%	4.3
E, Downtown Redmond	E1, Redmond Way	16.9	21.1	4.2	25%	4.8
	E2, Marymoor	18.1	23.9	5.8	32%	5.8
	E4, Leary Way	15.5	20.8	5.3	34%	5.6
MF1, 116th	D2A/E, NE 16th	8.0	11.7	3.7	46%	1.7
	D3, NE 20th	8.0	11.7	3.7	46%	1.7
	D5, SR 520	9.2	11.7	2.5	27%	1.7
MF2, BNSF	D2A/E, NE 16th	11.5	11.1	-0.4	-3%	1.3
	D3, NE 20th	11.5	11.1	-0.4	-3%	1.3
	D5, SR 520	16.4	12.7	-3.7	-23%	1.3
MF3, SR 520	D2A/E, NE 16th	14.5	12.8	-1.7	-12%	1.9
	D3, NE 20th	14.1	12.8	-1.3	-9%	1.9
	D5, SR 520	13.8	12.8	-1.0	-7%	1.9
MF5, SE Redmond	E1, Redmond Way	11.2	13.5	2.3	21%	2.2
	E2, Marymoor	13.6	15.5	1.9	14%	1.8
	E4, Leary Way	13.1	14.9	1.8	14%	1.8

[a] Connecting to 112th SE At-Grade Alternative (B2A). This is the connection for this alternative that results in the highest amount of impervious surface.
[b] Connecting to 112th SE Elevated Alternative (B2E). This is the connection for this alternative that results in the highest amount of impervious surface.
[c] Connecting to NE 12th Street.
[d] Includes reconstruction of existing roads.

Stormwater Treatment and Detention

In general, stormwater management would meet the requirements of the Ecology Manual. Within WSDOT right-of-way, the requirements of the Highway Runoff Manual (WSDOT, 2006) would be met which is equivalent to Ecology's manual. In addition, local jurisdiction requirements for stormwater management would be met.

Runoff from PGIS areas would require basic water quality treatment, with a goal to remove at least 80 percent of total suspended solids. The proposed maintenance facility is categorized as an industrial facility. In addition to motor vehicle traffic, storage and use of petroleum products and other chemicals would occur at the site, as well as maintenance activities. Therefore, enhanced treatment would be provided at the maintenance facility. Enhanced treatment, beyond providing basic treatment, has the added goal of reducing dissolved metals. A constructed stormwater wetland is the proposed

enhanced treatment for the maintenance facility. The guideways and stations have no motor vehicle traffic or other sources of pollution-generating activities and are therefore classified as non-PGIS, except where at-grade track crosses intersections. No stormwater treatment facilities would be required in these areas.

Some of the stormwater within the project area discharges to water bodies that have been designated by Ecology as exempt from requiring detention. These include Lake Washington, Mercer Slough, Lake Sammamish, and the Sammamish River. Stormwater detention would be provided for project runoff flowing to the remaining (nonexempt) water bodies. Facility alternatives would be developed to route runoff to detention-exempt water bodies where feasible. Non-PGIS runoff would be conveyed separately from PGIS runoff because it does not require water quality treatment. Where practical, runoff would be dispersed over pervious areas from elevated guideways where infiltration could occur. This would help to reduce the volume of runoff to be detained and reduce the size of the detention facilities.

Stormwater Detention

The temporary storage of stormwater runoff and subsequent release at a slower rate.

Stormwater Treatment

Stormwater ponds and underground vaults are used to remove sediments from stormwater. They collect sediments on the bottom of the pond or vault, where maintenance workers can clean them out on a regular basis.

Total Suspended Solids

Organic and inorganic particles that are entrained within and carried by water. The particles are typically sand, silt, and clay, but may include pebbles and larger rocks in fast-flowing water.

The East Link Project conceptual design includes development of a conceptual layout for major stormwater facilities to comply with the Ecology Manual. These facilities include stormwater ponds and underground vaults. Conceptual layouts of potential locations for stormwater facilities for the various alternatives can be found in Appendix G.

Most of the East Link Project lies within highly urbanized areas, with limited undeveloped area available for surface detention. As a result, most of the stormwater facilities would be within underground vaults. Project runoff in the Downtown Redmond Stormwater Service Area would require neither project-related detention nor treatment facilities because it would be within the Redmond Stormwater Service Area (refer to Section 4.9.2.2). Project runoff in the Downtown Bellevue Stormwater Service Area would only require project-related treatment facilities for the PGIS areas. The stormwater facilities provided by the project would meet the requirements of the local jurisdictions. (A tabular summary of the project stormwater facilities, including a comparison among alternatives, is presented in Appendix F4.9). As a result, stormwater impacts from the project would not be significant.

The Marymoor Alternative (E2) would reconfigure an Ecology embankment bordering Marymoor Park that is proposed by WSDOT to treat runoff from SR 520. If E2 is selected, Sound Transit proposes to reconstruct the highway shoulder and move the Ecology embankment from the shoulder to the median. This configuration would meet the highway requirements while also providing the required treatment of highway runoff using less land area.

Some opportunities exist for the dispersion of runoff to adjacent natural areas. Sound Transit's Environmental and Sustainability Management System encourages innovative measures to reduce stormwater runoff, such as low-impact development or other on-site measures, to be incorporated into the project where feasible. Other measures could include, but are not limited to, the following:

- Flow dispersal of runoff from at-grade trackways where they lie adjacent to Mercer Slough in Segment B
- Permanent landscaping of areas above tunnel segments in Segment C following construction
- Drip-dispersion of runoff from elevated guideway along portions of SR 520 that remain landscaped in Segment D

Low-impact development measures would be considered at a more advanced phase of project design, when the project is better defined.

Surface Water and Floodplain Impacts

Floodplains and floodways are subject to federal and local regulations. A floodplain is defined as the area adjacent to a stream or river that is inundated during the 100-year flood event. The floodway is the stream channel and adjacent portions of the floodplain that must be reserved in order to discharge the base flood (100-year flood) without increasing the water surface elevation more than 1 foot. The City of Redmond generally prohibits floodway encroachment unless mitigating measures achieve zero rise in the floodway, or base flood elevations increase less than 1 foot and significant environmental impacts are mitigated

(Ordinance 2259). The City of Bellevue prohibits construction that results in any rise of the base flood. An exception is construction using post-and-piling techniques, which is presumed without modeling to cause no rise in the base flood (Ordinance 5680). Fill within the 100-year floodplain must be mitigated by excavating an equal volume of material from within a proximate portion of the FEMA floodplain and at a comparable elevation to create "compensatory storage."

The East Link Project would generally employ elevated guideways to cross water bodies at a number of locations (Exhibits 4.9-1 to 4.9-5). The exact location of columns to support the elevated guideway would be determined during design, but columns would be located outside the stream channel floodway or floodplain when it is possible to span these areas. In general, an elevated guideway crossing of a stream, floodplain, or floodway would cause little or no impact. Impacts on specific streams are discussed below.

Segment A. No impacts on streams, floodplains, or floodways would occur within Segment A.

Segment B. The BNSF Alternative (B7) would cross approximately 415 feet of the Mercer Slough floodplain just north of I-90. A minimum of two columns would be located in the floodplain but not within a waterway channel. Compensatory storage requirements would be minor with no adverse impact.

Segment C. Segment C alternatives that connect from the 112th SE Bypass Alternative (B3) and the BNSF Alternative (B7) follow Sturtevant Creek for approximately 500 feet and 700 feet, respectively, where Sturtevant Creek first parallels 114th Avenue NE (see the callout in Exhibit 4.9-3). This includes all alternatives except the Bellevue Way Tunnel Alternative (C1T). The alternatives are elevated through this reach on supporting columns, and supporting columns are likely to be located in the creek's riparian buffer zone. In addition, because a FEMA flood insurance rate map has not been developed for this section of creek, the 100-year floodplain would need to be determined through modeling during future design. The upstream area draining to the creek is of modest size, approximately 400 acres. High flows in the creek would be limited, and the 100-year floodplain is expected to be narrow. The project design would avoid placing support columns for the elevated guideway in the channel to the extent practical. It is anticipated that riparian enhancement and potentially stream rerouting would be required to mitigate project impacts in this area. If an alternative following Sturtevant Creek is selected, the details of this mitigation would be further developed during detailed design.

Segment D. The Segment D alternatives would have no permanent impact to the floodplains or floodways. However, there would be project crossings at Kelsey Creek and several of its tributaries—Goff, Valley, and Sears creeks—which are discussed in this section.

Goff Creek. The SR 520 Maintenance Facility (MF3) would be constructed at an existing business park through which Goff Creek flows, as shown in Exhibit 4.9-4 (see Inset A). The west side of MF3 would extend over the creek. Sound Transit would consider two mitigation approaches in final design to accommodate the creek that could accommodate and potentially improve Goff Creek. In the first approach, the creek would remain in its present location, and two short, fish-passable culverts would be constructed under the rail loop on the western end of MF3 to accommodate the creek. A 50-foot-wide riparian buffer would be established on each side of the creek. In the second approach, the stream would be relocated around the west side of MF3, which would increase the length of the stream by about 220 feet. The Bel-Red Corridor Study identifies redevelopment opportunities for this area (City of Bellevue, 2007a). The Great Stream Concept presented in that study lists opportunities for improving the stream and its riparian habitat between SR 520 and Bellevue-Redmond Road, including the area that would be occupied by MF3. For that portion of the stream that crosses the proposed MF3 site, the Great Stream Concept recommends "Intensive re-vegetation to improve ecology." The riparian buffer mentioned above would achieve that concept. Any relocation of the creek would be done in a manner compatible with redevelopment plans of the Bel-Red Corridor.

The NE 16th At-Grade Alternative (D2A), NE 16th Elevated Alternative (D2E), and NE 20th Alternative (D3) cross Goff Creek at NE 16th Street where the stream is currently in a culvert (see Exhibit 4.9-4). Therefore, the light rail crossing would not affect the creek at this location.

Valley Creek and Sears Creek. The NE 20th Alternative (D3) would cross over areas where Valley Creek near 140th Avenue Northeast and Sears Creek about 0.2-mile farther east are confined within culverts. These areas are shown on Exhibit 4.9-4 and summarized in Table 4.9-3. At these locations, D3 would be a retained cut. The Sears Creek culvert is approximately 12 feet below the retained cut and would not be affected. The Valley Creek culvert at

Northeast 20th Street is a 6-foot-diameter metal culvert

with between about 1.0 and 1.5 feet of cover, which may require replacement regardless of whether D3 is retained cut, as currently configured, or at-grade. If Alternative D3 is selected, the existing culvert would need to be replaced with a bottomless, low-profile concrete box culvert, as shown in Exhibit 4.9-4, Inset B..

TABLE 4.9-3
Segment D Stream Crossings by Alternative

Stream	D2A	D2E	D3	D5
West Tributary of Kelsey Creek	Elevated crossing	Elevated crossing	Elevated crossing	Elevated crossing
Goff Creek	Crosses at existing culvert	Crosses at existing culvert	Crosses at existing culvert	Elevated crossing
Unnamed Tributary to Kelsey Creek	Portion of stream would be enclosed in pipe	Elevated crossing	Portion of stream would be enclosed in pipe	None
Valley Creek	Elevated crossing	Elevated crossing	Existing culvert would be replaced	Elevated crossing
Sears Creek	None	None	Crosses at existing culvert	None

Kelsey Creek. The NE 16th At-Grade (D2A), NE 16th Elevated (D2E), and NE 20th (D3) alternatives may affect a 0.2-mile segment of an unnamed tributary to Kelsey Creek (see Exhibit 4.9-4). This stream reach carries local runoff and is conveyed through a series of culverts and ditches along 136th Place NE. The at-grade alternatives, D2A and D3, would require the widening of 136th Place NE. The road passes through a highly commercialized area, and the road widening would eliminate the ditches, resulting in enclosing the entire stream in pipes through this section. The stream is ephemeral and does not flow during the drier months. The long-term water quality and flow impacts would not be affected by this change.

Segment E. The Segment E crossings at Bear Creek and Sammamish River are discussed in the following subsections.

Bear Creek. All Segment E alternatives would cross Bear Creek along the route of the former BNSF railway tracks, located about 250 feet downstream from NE Redmond Way. The current BNSF bridge opening creates a channel constriction. Flood modeling performed for the creek (Parametrix, 2007) indicates that the 100-year flood elevation upstream from the bridge is 39.6 feet, approximately 1.5 feet higher than downstream from the bridge. The Redmond Way Alternative (E1) would have an elevated crossing over Bear Creek along the route of the inactive BNSF bridge. Construction of columns on this embankment would have minimal impact on the floodplain and would not change the existing Bear Creek channel.

The Marymoor (E2) and Leary Way (E4) alternatives would span Bear Creek on a bridge extending for a distance of about 100 feet on either side of the center of the 30-foot bridge opening. The existing BNSF railway embankment would be widened to about 50 feet to accommodate both retained fill for the track and a 15-foot-wide parallel strip for a bike path (to be constructed by others). The old railroad bridge structure would be removed but the geometry of the stream would not be changed. The lowest portion of the proposed light rail bridge would be at least 3 feet above the 100-year flood elevation of Bear Creek.

The fill placed along the railroad embankment would displace approximately 150 cubic yards of floodplain storage. Compensatory storage, which is the creation of equivalent storage capacity in another location, is required by the City of Redmond and would be provided near the edge of the floodplain in the vicinity of the rail crossing. The existing stream opening would remain unaltered. Two culverts about 60 feet south of the bridge would remain as they are. If disturbed during construction of guideways, these culverts would be replaced at their existing locations and elevations. Disturbed areas in the floodplain would be revegetated with native riparian vegetation.

In summary, the new project bridge would have no permanent impact on Bear Creek. The existing stream opening would remain unaltered. Although the height of the existing railroad embankment would be raised by the retained fill, this would not affect the flow conditions through the bridge because the existing railroad embankment lies above the 100-year water surface elevation and is not overtopped. The flow conditions and flood water surface elevations in the vicinity of the bridge would remain unchanged.

Sammamish River. All Segment E alternatives would cross the Sammamish River north of Marymoor Park. Each alternative would be elevated at the point of crossing and would cross the river at a different location (see Exhibit 4.9-5). Where the Redmond Way Alternative (E1) and the Leary Way Alternative (E4) would cross the Sammamish River, the floodway is about 600 feet and 200 feet wide, respectively. For the Marymoor Alternative (E2), the floodway is about

235 feet wide and the floodplain is about 3,050 feet wide. In all cases, at least one column would be located in the floodway, but flooding impacts would be negligible.

The largest amount of compensatory storage would be required for E2, where a 1,000-foot-long at-grade segment in the floodplain adjacent to SR 520 would displace approximately 650 cubic yards below the 100-year water surface elevation. The average depth of fill below the 100-year water elevation would be less than 0.5-foot. E2 would include compensatory storage as required. Further study is required to select locations where compensatory storage would be developed. It may be that Marymoor Park could be enhanced through grading, or compensatory storage could be developed along the Sammamish River north of SR 520.

Groundwater

Depending on the final alternative and maintenance facility selected, the East Link Project would result in between 14 to 31 acres of new impervious area (Section 4.9.3.2) within the project area. The additional impervious area would reduce the amount of infiltration into the soil and reduce groundwater recharge. Because of the highly linear nature of the project, this impact would occur across many miles of project path and is not expected to result in a substantial decline in groundwater level or other serious groundwater impact.

Two unique aspects of this project related to groundwater are the potential for groundwater to enter the proposed tunnels under Downtown Bellevue in Segment C and the impact on the groundwater protection zones in Redmond, which are discussed in the following subsections.

Tunnel Seepage. Several alternatives in Segment C involve constructing tunnels under Downtown Bellevue. When constructing tunnels, a drainpipe would be installed to convey groundwater that may seep into the tunnel. Based on tunnel design criteria for the Central Link Project (Pine Street Stub Tunnel) of 0.2 gallon per minute per 250 feet of tunnel, the three tunnel alternatives (Bellevue Way Tunnel [C1T], 106th NE Tunnel [C2T], or 108th NE Tunnel [C3T]) are estimated to collect up to 6 or 7 gallons per minute of groundwater. The tunnel would be tightly waterproofed using the same techniques as used in the Central Link Project. These small flows would be pumped into the city sanitary sewer system for disposal and would not be expected to substantially affect the groundwater level in the central Bellevue area.

Redmond Wellhead Protection Zone. As stated in Section 4.9.2.4, the City of Redmond identifies four WPZs. Zones 3, 2, and 1, respectively, lie in increasing proximity to the city's municipal wells and therefore have increasingly stringent requirements to protect the underlying aquifer from contaminants that might be introduced as a result of land use activities. All Segment E alternatives would cross through all four WPZs. As shown in Exhibit 4.9-5, the proposed route and station alternatives in Downtown Redmond would lie within Zones 1 and 2. There would be no vehicle maintenance nor storage or use of hazardous materials associated with the light rail tracks and the stations. Project runoff would be directed to the existing regional stormwater management system for treatment and discharge to the Sammamish River. The project would therefore result in no additional impact on the groundwater in this area.

South of Bear Creek, the SE Redmond Park-and-Ride Lot and the SE Redmond Maintenance Facility (MF5) would lie within Zone 3. There would be vehicle maintenance work and some fuels and hazardous materials would be stored at the maintenance facility. The soils in this area are permeable. Runoff from these project facilities would be collected, treated, and infiltrated onsite, as is the current practice within this area. The Redmond City Code (Wellhead Protection Zone Performance Standards) lists the requirements for stormwater management for developments within Zone 3. Applicable provisions that would be incorporated into project design to protect groundwater quality include the following:

- Containment and treatment of runoff from vehicle fueling, maintenance, and storage areas
- Secondary containment for hazardous materials unloading and storage areas
- Stormwater best management practices (BMPs) approved by the City's Technical Committee

These measures would protect groundwater quality. Standard stormwater BMPs would be required for WPZ 4 and would be implemented as discussed below in Section 4.9.3.3, Impacts During Construction.

4.9.3.3 Impacts During Construction

Impacts Common to All Build Alternatives

The potential water quality impacts resulting from construction activities are increased turbidity and sedimentation in the receiving streams as a result of stormwater runoff from disturbed construction sites. Erosion and sedimentation typically occur when rainfall and stormwater runoff erode soil and deposit eroded materials downslope or downstream from the

construction area. Erosion and sedimentation can result from a variety of potential actions associated with construction, including the following:

- Removing vegetation that exposes soil to erosion
- Exposed soil resulting from grading, filling, and excavation
- Vehicles tracking soils onto roads
- Construction in or near streams or drainage courses
- Constructed slopes that collect and concentrate stormwater, causing erosion
- Dewatering of trenches and tunnels

The runoff from newly poured concrete surfaces can have a high pH, often above pH 9, which can result in water quality problems. In addition, total suspended solids from the concrete fines may result in a milky-white appearance of the runoff, exceeding turbidity requirements. Both of these issues were encountered during construction of the Central Link Project. Because the total amount of ground disturbance during construction would be more than 1 acre, an NPDES general construction permit would be required for this project. One of the requirements of this permit is a project-specific stormwater pollution prevention plan (SWPPP). The SWPPP would be developed and implemented in accordance with the Sound Transit Environmental and Sustainability Management System. This plan would include a temporary erosion and sediment control plan (TESC) and would employ BMPs during construction to minimize the potential for soil erosion and sedimentation and to protect water quality. Potential BMPs include the following:

- Minimizing the amount of cleared area at a construction site
- Stabilizing construction entrances and haul roads using quarry spalls; truck tire washes may be used at construction entrances, as necessary
- Constructing silt fences downslope from exposed soil
- Constructing temporary ditches to route runoff around or through construction sites, with periodic straw bales or rock check dams
- Providing temporary plastic or mulch to cover soil stockpiles and exposed soil
- Using straw wattles to reduce the length of unbroken slopes and minimize concentration of runoff
- Using temporary erosion control blankets or mulch on exposed steep slopes to minimize erosion prior to vegetation establishment
- Constructing temporary sedimentation ponds for removal of solids from concentrated runoff and dewatering prior to discharge
- Conducting vehicle fueling and maintenance activities no closer than 100 feet from a water body or ditch

A TESC plan also would include a water quality monitoring plan and a schedule for inspection of the erosion control measures for effectiveness. Water from tunnel dewatering would be treated as necessary to meet discharge standards. A certified erosion control specialist would be employed to conduct the inspections, and deficiencies would be promptly corrected. These measures would minimize the likelihood for serious water quality problems during construction.

It takes several months for concrete to cure enough that the pH decreases to acceptable levels. Stormwater runoff would be tested and if excessive levels of pH or turbidity are found, water quality treatment of the runoff prior to release to storm sewers or a receiving water body would occur.

For construction within and over streams or other water bodies, an HPA would be required. The HPA would be obtained from WDFW prior to the start of work. The project would comply with the stream protection measures of the HPA, including diversion of stream flow around the construction area and limiting the construction period to the required "work window," a period of the year identified in the HPA when a minimum of impact would occur to fish.

Potential Impacts by Alternative

Several alternatives would result in the temporary disturbance of stream channels. The Sturtevant Creek channel may be affected by the Segment C alternatives that connect from the 112th SE Bypass Alternative (B3) and the BNSF Alternative (B7). This includes all Segment C alternatives except the Bellevue Way Tunnel Alternative (C1T). Groundwater seepage from tunnel boring activities for the 106th NE Tunnel Alternative (C2T) and the 108th NE Tunnel Alternative (C3T) could be up to 250 gallons per minute. This is typical of other projects with deep underground parking structures or foundations that have recently been constructed in Downtown

Bellevue, and the existing storm drainage system has had adequate capacity to accept this quantity of pumped groundwater. Therefore, the collected groundwater would be treated to remove sediment and reduce turbidity prior to discharge into the storm drainage system. Cut-and-cover tunnels are not expected to encounter substantial groundwater, and, therefore, dewatering is expected to be needed less for these tunnel sections. The banks of Bear Creek would be disturbed by the construction of a bridge associated with the Marymoor (E2) and Leary Way (E4) alternatives. The SR 520 Maintenance Facility (MF3) would require the reconstruction or relocation of Goff Creek. Because of the presence of flowing water, stream construction carries a substantial risk of temporary channel erosion and downstream turbidity and sedimentation.

Clearing, grading, and other construction-related activities in areas with steep slopes or unstable soils has the potential to cause severe erosion problems. Steep slopes are defined as areas with slopes exceeding 15 percent that also have unstable soils. They also encompass slopes greater than 40 percent. Segment A would cross over a large area that is designated as an erosion-hazard area in Mercer Island; however, nearly all construction would occur within the existing roadbed of I-90 and would therefore not be expected to pose a substantial risk for erosion. The BNSF Alternative (B7) would cross a steep area that is more than 1 mile long, located east of Mercer Slough and west of I-405. However, this portion of the alternative would be constructed within an existing graded railroad bed where only minor grading and minimal hillside disturbance would occur.

4.9.4 Potential Mitigation Measures

As previously described, BMP measures would be installed during construction to minimize erosion and to protect water quality.

For any construction work within or above a stream channel, HPA requirements would be followed, including adhering to the prescribed fish window and temporary diversion of the creek around the work area during construction. Permanent stormwater treatment and detention facilities would be installed to minimize the adverse flow and water quality effects resulting from project runoff. In addition, during detailed design, opportunities to apply low-impact development measures would be identified. Compensatory storage would be provided to offset the effects of any fill placed within floodplains. The SE Redmond Station and SE Redmond Maintenance Facility (MF5) both lie within Redmond's WPZ 3. Stormwater treatment and infiltration facilities constructed to manage runoff from these project components would meet Redmond's WPZ performance standards.

Several of the project alternatives were identified to have potential adverse impacts on water resources. The following mitigation measures would eliminate any significant adverse impacts on water resources:

- If any of the Segment C alternatives that connect from the 112th SE Bypass Alternative (B3) or the BNSF Alternative (B7) is selected, a combination of careful guideway column placement and stream relocation would be carried out to avoid or mitigate impacts on Sturtevant Creek.
- If the NE 20th Alternative (D3) is selected, the existing shallow culvert crossing of NE 20th Street by Valley Creek would be replaced with a culvert that is structurally capable of supporting the light rail crossing at this location. This culvert would be constructed to meet applicable fish passage criteria.
- The Marymoor Alternative (E2) would relocate the Ecology embankment proposed by WSDOT to treat runoff from SR 520 where this highway crosses the north side of Marymoor Park. The East Link Project would provide for equivalent treatment of highway runoff if this alternative is selected.
- If the SR 520 Maintenance Facility (MF3) is selected, Goff Creek could be relocated several hundred feet to the west to avoid the facility. Alternatively, the stream could be restored in its present location and the culverts could be replaced by ones that allow fish passage and migration. Stream relocation and restoration should be done in a manner compatible with the redevelopment plans for the Bel-Red Corridor.

During final design, opportunities for on-site control of stormwater runoff would be explored. Emphasis would be placed on infiltration and low-impact-development measures to reduce runoff from the project. The final design would comply with federal, state, and local regulations to protect and manage water resources in the project area.