April 2015

Federal Way Link Extension

Draft Environmental Impact Statement

SOUNDTRANSIT
Central Puget Sound
Regional Transit Authority

U.S. Department of Transportation
Federal Transit Administration

SOUNDTRANSIT

April 10, 2015

Dear Recipient:

The U.S. Department of Transportation Federal Transit Administration (FTA) and Sound Transit (the Central Puget Sound Regional Transit Authority) have prepared this Draft Environmental Impact Statement (Draft EIS) on the proposed Federal Way Link Extension. Sound Transit is the project proponent.

The Draft EIS has been prepared pursuant to the National Environmental Policy Act (42 U.S.C. 4321 to 4370e) and the State Environmental Policy Act (Ch. 43.21C RCW). It has been prepared to inform the public, agencies and decision makers about the environmental consequences of building and operating the Federal Way Link Extension in the cities of SeaTac, Kent, Des Moines, and Federal Way. The Draft EIS examines the project alternatives identified by the Sound Transit Board in September 2013.

The major choices for the project involve the route of the light rail line and station locations. The Sound Transit Board will consider the Draft EIS, public and agency comments, and other information before identifying a preferred route and station locations. FTA and Sound Transit will prepare a Final EIS which will respond to comments on the Draft EIS and include an evaluation of impacts and mitigation for the preferred alternative and other alternatives considered. After completion of the Final EIS the Sound Transit Board will select the project to be built. FTA will also issue a Record of Decision, which will state FTA's decision on the project and list Sound Transit's mitigation commitments to reduce or avoid impacts.

The Draft EIS includes appendices and technical reports on the enclosed CD. Please see the Fact Sheet of this Draft EIS regarding document availability and who to contact for further information about the Draft EIS.

Sincerely,

Kent Hale
Environmental Affairs and Sustainability

Central Puget Sound Regional Transit Authority • Union Station
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FEDERAL WAY LINK EXTENSION
KING COUNTY, WASHINGTON
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Submitted pursuant to
the National Environmental Policy Act (NEPA) (42 USC 4322(2)(c))
and the State Environmental Policy Act (SEPA) (Ch. 43.21C RCW)
by the
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL TRANSIT ADMINISTRATION
and
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY
(Sound Transit)
in cooperation with
FEDERAL HIGHWAY ADMINISTRATION
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
KING COUNTY METRO
CITY OF SEATAC
CITY OF DES MOINES
CITY OF KENT
CITY OF FEDERAL WAY

3/23/15
Date of Approval

Regional Administrator
For Federal Transit Administration, Region 10

3/23/15
Date of Approval

SEPA Responsible Official
For Central Puget Sound Regional Transit Authority

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Fact Sheet

Proposed Action

The Central Puget Sound Regional Transit Authority (Sound Transit) is proposing to expand the regional light rail system south from the city of SeaTac to Federal Way, Washington. The proposed light rail extension, called the Federal Way Link Extension (FWLE, and formerly known as the Federal Way Transit Extension), would be within the cities of SeaTac, Des Moines, Kent, and Federal Way in King County. The proposed project is part of the Sound Transit 2 (ST2) Plan, funding for which was approved by voters in 2008 (Sound Transit, July 2008). Currently, there is projected funding to construct to Kent/Des Moines in the vicinity of Highline College.

The proposed project, which is part of the larger regional network of light rail proposed under the ST2 Plan, would begin at the future Angle Lake Station in SeaTac and end in the Federal Way Transit Center area. The 7.6-mile-long project corridor generally parallels State Route (SR) 99 and Interstate 5 (I-5), which are the major north-south routes through the FWLE corridor. It generally follows a topographic ridge between Puget Sound and the Green River Valley where the city limits of SeaTac, Des Moines, Kent, and Federal Way meet.

This Draft Environmental Impact Statement (EIS) evaluates several build (light rail) alternatives and a No Build Alternative, which considers how the transportation system would operate if the proposed project were not built. The No Build Alternative also provides a baseline against which to measure the impacts of the build alternatives. The light rail alternatives include at-grade, trench, and elevated light rail alignments with different station configurations. Four alternatives are evaluated, each with between four and nine station or alignment options.

Project Proponent and State Environmental Policy Act (SEPA) Lead Agency

Central Puget Sound Regional Transit Authority (Sound Transit)
401 South Jackson Street
Seattle, Washington 98104-2826
www.soundtransit.org

Dates of Construction and Opening

Sound Transit proposes to begin construction of the FWLE by 2019, and the light rail line is expected to open to Kent/Des Moines in 2023.

National Environmental Policy Act (NEPA) Lead Agency

Federal Transit Administration
915 Second Avenue, Suite 3142
Seattle, Washington 98174-1002
www.fta.dot.gov/about/region10

NEPA Responsible Official

Richard Krochalis, Regional Administrator for Region 10
Federal Transit Administration
915 Second Avenue, Suite 3142
Seattle, Washington 98174-1002

SEPA Responsible Official

Perry Weinberg, Director, Office of Environmental Affairs and Sustainability
Sound Transit
401 South Jackson Street
Seattle, WA 98104-2826

Contacts for Additional Information

Sound Transit
Kent Hale, Senior Environmental Planner (206) 398-5103
Erin Green, Environmental Planner (206) 398-5464
Tralayne Myers, Community Outreach Specialist (206) 398-5014
Mailing Address:
Sound Transit
401 South Jackson Street
Seattle, WA 98104-2826

Federal Transit Administration
Steve Saxton, Transportation Program Specialist
Federal Transit Administration Region 10
915 2nd Avenue, Suite 3142
Seattle, WA 98174-1002
(206) 220-4311

Potential Permits and Approvals

Federal Agencies	
Federal Highway Administration (FHWA)	• The following would be needed if the project to be built involved use of I-5 right-of-way: • Air Space Lease for Use of Interstate Right-of-Way • Limited Access Break • Operations and Maintenance Agreement • NEPA Record of Decision • Design Deviation Approval • I-5 Compatibility Report
Federal Transit Administration (FTA)	• NEPA Final Environmental Impact Statement and Record of Decision • Section 106 • Section 4(f)
U.S. Army Corps of Engineers	• Clean Water Act • Section 404 Wetlands Approval
U.S. Department of the Interior	• National Historic Preservation Act Section 106 • U.S. Department of Transportation Section 4(f)
U.S. Fish and Wildlife Service	• Federal Endangered Species Act Review
National Parks Service	• Section 4(f)
National Oceanic and Atmospheric Administration Fisheries Service	• Federal Endangered Species Act Review
State, County, and Regional Agencies	
Sound Transit	• SEPA Project Approval
Washington Department of Fish and Wildlife	• Hydraulic Project Approval
Washington State Department of Archaeology and Historic Preservation	• National Historic Preservation Act Section 106 Review
Washington State Department of Ecology	• Coastal Zone Management Consistency Certification • National Pollutant Discharge Elimination System Stormwater Discharge Permit, Clean Water Act Section 402 • Underground Storage Tank (UST) 30-Day Notice • Wastewater Discharge Permit • Water Quality Certification: Clean Water Act Section 401
Washington State Department of Ecology and Puget Sound Clean Air Agency	• Notice of Construction (Air Quality)
Washington State Department of Transportation	• Air Space Lease: State Transportation Routes and Interstate Right-of-Way (with FHWA) • Construction Oversight Agreement • Utility Franchise • Design Documentation Package • General Permits • Limited Access Break (with FHWA) • Operations and Maintenance Agreement (with FHWA) • Survey Permits • I-5 Compatibility Report (with FHWA)
Cities	
SeaTac, Des Moines, Kent and/or Federal Way	• Administrative Conditional Use and/or Design Review Approvals, Binding Lot Adjustments, and Site Plan Approvals

	• Building Permits: Mechanical, Plumbing, Electrical, Signs, Fences, and Awnings • Comprehensive Plan or Development Code Consistency Review, Special Use Permits, and/or Zoning Revision Applications • Construction Permits: Clearing and Grading, Demolition, Drainage, Driveways, Haul Routes, Landscape and Irrigation, Parking, Sanitary Sewers, Side Sewers, Street Use, Tree Protection, Use of City Right-of-Way, and Walls • Conveyance (elevators and/or escalators) • Environmental Critical Areas/Sensitive Areas Review including Wetlands, Streams, Steep Slopes, Flood Zones, Critical Habitat, and Buffers • Fire Protection and Hydrant Use Permits • Inspection Record Approval and Occupancy Permits • Noise Variances • Reviews and Approvals: Planning, Design, and Arts Commissions • Right-of-Way Permit or Franchise (utilities) • Street and Alley Vacations • Permanent, Interim, or Temporary Street Use Permits • Access or Use Easements for City-owned Properties • Removal/Abandonment of Residential USTs or Underground Heating Oil Tanks • Traffic, Transportation, and Parking Approvals • Use of City Right-of-Way (for construction) • Water Meter and Water Main Permits and Approvals • Floodplain Development License • Master Use Permit • Master Development Plan Approval
Other	
Utility Providers	• Pipeline and Utility Crossing Permits • Easements and Use Agreements

Principal Contributors

This EIS was prepared by consultants at the following firms: CH2M HILL, HDR Inc., ATS, Entech Consulting Group, Michael Minor and Associates, BERK Associates, and PRR. See Appendix A2 for a detailed list of preparers and the nature of their contributions.

Date of Issue of Draft Environmental Impact Statement

April 10, 2015

Commenting on the Draft EIS

The Draft EIS will be available for a comment period of 45 days. Comments on the Draft EIS can be made in writing, by e-mail, or at the public hearings. All comments are due by close of business on May 26, 2015. Send written comments to the following address:

Attention: Federal Way Link Extension Draft EIS Comments
Sound Transit
401 South Jackson Street
Seattle, Washington 98104

E-mail comments should be sent to FWLE@soundtransit.org. Written or e-mailed comments should include an addressee and return address. You may also offer comments at a public hearing/open house:

May 6, 2015 - Federal Way
4:00 p.m. to 7:00 p.m. (public hearing begins at 5:30 p.m.)
Federal Way Community Center
876 S 333rd Street
Federal Way, WA 98003

May 7, 2015 - Des Moines
4:00 p.m. to 7:00 p.m. (public hearing begins at 5:30 p.m.)
Highline College Student Union Building
2400 S 240 Street
Des Moines, WA 98198

Next Actions

Following publication of this Draft EIS and the close of the public comment period, the Sound Transit Board of Directors is expected to consider the comments received and identify a Preferred Alternative for evaluation in the Final EIS. The Final EIS will analyze the Preferred Alternative along with the other proposed light rail alternatives and the No Build Alternative. The Final EIS will also respond to the public and agency comments on the Draft EIS. Following issuance of the Final EIS, the Sound Transit Board of Directors will make a final decision on the FWLE alignment and station locations to be built.

The Federal Transit Administration will then issue a Record of Decision (ROD) describing the project Sound Transit will build and how it will avoid, minimize, and mitigate environmental impacts.

Related Documents

- Final Supplemental Environmental Impact Statement, Long-Range Plan Update (Sound Transit, 2014)
- Federal Way Transit Extension Alternatives Analysis Level 1 Evaluation (Sound Transit, 2013a)
- Federal Way Transit Extension Alternatives Analysis Level 2 Evaluation (Sound Transit, 2013b)

- Final Environmental Impact Statement, Transportation 2040: Metropolitan Transportation Plan for the Central Puget Sound Region (Puget Sound Regional Council [PSRC], 2010a)
- Sound Transit 2: A Mass Transit Guide, The Regional Transit System Plan for Central Puget Sound (Sound Transit, 2008)
- Regional Transit Long-Range Plan Final Supplemental Environmental Impact Statement (Sound Transit, 2005a)

All the above Sound Transit documents are available on the Sound Transit Web site, www.soundtransit.org.

Cost of Document and Availability for Review and/or Purchase

This Draft EIS is available for public review in a variety of formats and locations. It is available on the Sound Transit website (http://www.soundtransit.org/Projects-and-Plans/Federal-Way-Link-Extension) and on compact disk (CD) at no cost. Paper copies are available for the cost listed below, which does not exceed the cost of reproduction:

- Executive Summary – free
- Draft EIS – $25.00
- Technical Reports – $15.00 each
- Conceptual Design Drawings (Appendix F) – $25.00

Paper copies of these documents are available for review or purchase at the offices of Sound Transit, Union Station, 401 South Jackson Street, Seattle, Washington 98104. To request any of the documents, please contact Erin Green at (206) 398-5464. To review them, please call the Sound Transit librarian at (206) 398-5344 weekdays from 8:00 a.m. to 5:00 p.m. to arrange an appointment.

Paper and CD copies of the Draft EIS documents are also available for review at the following public places:

- King County Library System:
  - Des Moines Library, 21620 11th Ave S, Des Moines
  - Kent Library, 212 2nd Ave N, Kent
  - Woodmont Library, 26809 Pacific Highway S, Des Moines
  - Federal Way 320th Library, 848 S 320th Street, Federal Way
  - Federal Way Library, 34200 1st Way S, Federal Way
- Washington State Library: Point Plaza East, 6880 Capitol Boulevard SE, Tumwater

Table of Contents

List of Tables

List of Exhibits

Appendices

*Provided on CD with the Draft EIS and available on the project website at http://www.soundtransit.org/Projects-and-Plans/Federal-Way-Link-Extension. Printed versions are available on request.

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4.0 Affected Environment and Environmental Consequences

This chapter discusses the affected environment and environmental consequences for the topics listed in the text box on the right. Each section describes the resource study area, applicable laws and regulations with which the project would comply, and the long-term impacts of each alternative considered in this Draft EIS. Mitigation measures are proposed when potential impacts could not be avoided. The first part of each section summarizes the key findings for the affected resource. Impacts are described by alternative. Station or alignment options are described or quantified as an increase or decrease relative to the alternative(s) they are associated with. For discussion of potential impacts with the I-5 and SR 99 to I-5 alternatives, locations where impacts could be reduced by shifting the alignment closer to I-5, as described in Section 2.2.4, are noted.

Environmental Topics in Chapter 4

NEPA and SEPA regulations require that an EIS disclose direct, indirect, and cumulative impacts (also called "effects") of a proposed action on the environment. *Direct impacts* are caused by the action and occur at the same time and place (40 Code of Federal Regulations [CFR] 1508.8(a)). *Indirect impacts* are caused by the action and are later in time or farther removed in distance but still are reasonably foreseeable (40 CFR 1508.8(b)), such as changes in land use patterns and related effects on air quality. Impacts can be either temporary (short-term), such as construction impacts, or permanent (long-term), such as with property conversion to a transportation use, or impacts due to project operation. For this Draft EIS, the impacts analysis for each resource is divided into long-term impacts (in Chapter 3 for transportation and Chapter 4 for environmental resources) and short-term construction impacts (Chapter 5).

A *cumulative impact* results from the proposed action's incremental impact when added to those of other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7).

Cumulative impacts are considered because the public and government agencies need to evaluate a proposed action and its alternatives in a broad perspective, including how the project might interact with impacts that persist from past actions, with present-day activities, and with other projects that are planned but have not been built yet (reasonably foreseeable future actions). Cumulative impacts are discussed in Chapter 6.

This chapter also describes potential mitigation measures where potential impacts cannot be avoided. The Final EIS will specify mitigation measures with more detail, and any eventual FTA grant funding would be conditioned on Sound Transit's compliance with the identified mitigation measures.

4.1 Acquisitions, Displacements, and Relocations

4.1.1 Summary

All Federal Way Link Extension (FWLE) alternatives and options would require acquiring property as well as displacing and relocating some uses. Table 4.1-1 shows potential property acquisitions and displacements for each alternative along with a range of impacts with station and/or alignment options. The range presented includes the lowest and highest possible number of impacts associated with each alternative and may include one or more of the station or alignment options.

TABLE 4.1-1
Summary of Properties Affected and Displacements by Alternative

	Number of Potential Properties Affected (Range with Options)[a]	Number of Business Displacements (Range with Options)	Number of Residential Units Displaced (Range with Options)
SR 99 Alternative	**293** (240-315)	**104** (84-140)	**36** (36-108)
I-5 Alternative	**163** (155-172)	**29** (4-46)	**285** (186-305)
SR 99 to I-5 Alternative	**120** (117-128)	**43** (23-56)	**106** (106-152)
I-5 to SR 99 Alternative	**341** (298-341)	**98** (85-119)	**244** (244-251)

[a] Includes full and partial property acquisitions.

The I-5 Alternative would result in the greatest number of residential displacements, and the SR 99 Alternative would result in the largest number of business displacements. The I-5 to SR 99 Alternative would result in the greatest number of property acquisitions and total displacements (business and residential combined). The tables and maps in Appendix D4.1 identify each potentially affected parcel by alternative.

4.1.2 Introduction to Resources and Regulatory Requirements

Building and operating the FWLE would require acquiring public and private property for guideways, stations, parking, and other facilities, as well as displacing and relocating some residential, commercial, and public uses. This section summarizes likely property acquisitions and permanent easements based on current conceptual designs. These

impacts are representative and should not be considered the final determination regarding property acquisition.

There are two types of property acquisition discussed in this section:

- **Partial acquisition,** where Sound Transit would acquire part of a parcel and generally would not displace the existing use. In a few instances some of the businesses or residential units on a parcel would be displaced.
- **Full acquisition,** where Sound Transit would acquire the full parcel and displace the current use; full acquisitions include parcels that might not be fully needed for the FWLE but would be affected to the extent that existing uses would be substantially impaired (e.g., loss of parking or access).

Some acquisitions would be for staging areas and would only be needed during construction (discussed in Chapter 5). These areas are included in the acquisitions discussed in this section. Because civil construction could take up to 3 years, Sound Transit would permanently acquire such property and the displacements would be permanent. Following construction, many of these properties could be available for redevelopment and could attract new businesses and residents.

In addition to the potential property acquisitions described in this section, the FWLE could require temporary construction easements on private property as well as the use of public rights-of-way owned by WSDOT and the cities of SeaTac, Des Moines, Kent, and Federal Way. The area of temporary easements is not defined in this Draft EIS. Approval from WSDOT and the Federal Highway Administration would be required for use of I-5 right-of-way. Other impacts associated with acquisitions and displacements are discussed in Section 4.2, Land Use; Section 4.3, Economics; and Section 4.4, Social Impacts, Community Facilities, and Neighborhoods.

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, is a federal requirement, and therefore project planning incorporates measures to comply with it. The act and its amendments direct how federal agencies, or agencies receiving federal financial assistance for a project, will compensate property owners or tenants who need to relocate if they are displaced by the project.

Sound Transit's *Real Estate Property Acquisition and Relocation Policy, Procedures, and Guidelines* (Sound Transit, 2013a) guides its compliance with federal law and state law (Chapter 8.26 Revised Code of Washington [RCW] and Chapter 468-100 Washington Administrative Code [WAC]) so that property owners are treated uniformly and equitably.

4.1.3 Affected Environment

The study area for the acquisitions, displacements, and relocations analysis generally follows the I-5 and SR 99 corridors through the cities of SeaTac, Des Moines, Kent, and Federal Way and includes the parcels that are within the areas where light rail alignments, stations, and facilities or associated road improvements would require permanent property acquisition for public right-of-way. Areas needed for staging around stations are also included.

4.1.4 Environmental Impacts

Sound Transit analyzed the potential right-of-way needs of the alternatives and parcel data from King County Department of Assessments to identify properties that would be affected by each alternative and the approximate area of each parcel that would be required. Appendix D4.1 provides further information on the potentially affected parcels.

Sound Transit evaluated the projected effects on each parcel to assess whether the parcel might need to be fully or partially acquired. Sound Transit verified the current land use, including the number of businesses or residences on affected parcels, using 2013 King County Assessor data and field verification (April 2013 and February 2014). The number of acquisitions and displacements for each alternative and its associated options is summarized in Table 4.1-1 and in Appendix D4.1.

The estimates below reflect the conditions at the time the analysis was conducted. Because properties that are currently underdeveloped or vacant could be developed between completion of this Draft EIS and the time of construction, the number and/or type of displacements could change. During final design, Sound Transit would prepare detailed assessments of acquisitions, uses, underlying ownership, and the parties involved in displacements for the alternative selected.

4.1.4.1 No Build Alternative

Under the No Build Alternative, no property acquisition would occur and no businesses or residences would be displaced.

4.1.4.2 Build Alternatives

The following subsections describe the direct and indirect impacts of the build alternatives. All permanent property acquisition is discussed in the Direct Impacts section; temporary property easements related to construction are discussed in Chapter 5.

Direct Impacts

Potential direct impacts associated with property acquisition are described below by alternative. Table 4.1-2 shows the number of properties that would be acquired by land use type and by partial or full acquisition.

It is important to note that many of the partial acquisitions are considered "sliver" acquisitions because they are small in size and would not affect the use of the property. Alternatives with large numbers of "sliver" acquisitions might appear to have a greater level of impact than would actually occur because most of these acquisitions would not affect the use of the property or result in any displacements. The total area that would be converted to public transportation use is discussed in Section 4.2, Land Use, and is summarized in Table 4.2-1.

This table also presents the number of businesses and residences that would be displaced for each alternative. The impacts for station and alignment options are provided as the increase or decrease in impacts relative to the associated alternative.

SR 99 Alternative

For the SR 99 Alternative, property acquisitions would occur on both sides of SR 99 and would generally occur where widening is needed at intersections and for stations and associated parking. The SR 99 Alternative would affect 293 parcels, resulting in displacement of 36 residences and 104 businesses. The residential displacements occur at two apartment complexes. A total of 104 businesses would be displaced from both single-use properties and business complexes.

"Public/institutional" properties affected include full acquisitions of the Highline College Outreach Center and the Redondo Heights Park-and-Ride (which would be replaced with a station).

TABLE 4.1-2
Number of Potential Parcels Affected and Displacements by Alternative

Alternative		Number of Parcels Affected	Single-Family		Multi-Family		Commercial and Industrial		Public and Institutional		Vacant		Total		Displacements	
			Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Business	Residential
SR 99 Alternative		**293**	**5**	**—**	**16**	**2**	**156**	**38**	**15**	**2**	**47**	**12**	**239**	**54**	**104**	**36**
S 216th Station Options	216th West Station	+6	—	—	-1	—	-2	+4	—	—	+4	+1	+1	+5	+13	—
	216th East Station	+5	-1	—	+4	+1	-1	+3	—	—	-1	—	+1	+4	+2	+26
Kent/Des Moines Station Options	Kent/Des Moines HC Campus Station	+19	—	+18	+4	—	-5	-3	+1	+1	+2	—	+2	+17	-7	+39
	Kent/Des Moines HC from S 216th W Station	+23	—	+18	+2	—	-15	+5	-5	+2	+13	+2	-5	+28	+9	+44
	Kent/Des Moines SR 99 Median Station	+1	—	—	+1	+1	+7	-7	-1	-1	+1	—	+8	-7	+2	+14
	Kent/Des Moines SR 99 East Station	-9	-1	—	+1	+2	-5	-5	—	-1	—	—	-5	-4	-1	+34
S 260th Station Options	S 260th West Station	-15	—	—	—	—	-25	+12	-2	+1	-5	+4	-32	+17	+18	—
	S 260th East Station	-6	—	—	—	—	-8	+9	-3	—	-6	+2	-17	+11	+21	+3
S 272nd Redondo Trench Station Option		-21	+2	+4	+2	—	-24	+6	-5	—	-10	+4	-35	+14	—	+4
Federal Way SR 99 Station Option		-8	—	—	—	—	-13	+4	-2	—	+3	—	-12	+4	-13	—

TABLE 4.1-2
Number of Potential Parcels Affected and Displacements by Alternative

Alternative		Number of Parcels Affected	Single-Family		Multi-Family		Commercial and Industrial		Public and Institutional		Vacant		Total		Displacements	
			Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Business	Residential
I-5 Alternative		**163**	**29**	**18**	**10**	**16**	**14**	**7**	**20**	**29**	**14**	**6**	**87**	**76**	**29**	**285**
Kent/Des Moines Station Options	Kent/Des Moines At-Grade Station	-5	+1	-1	-1	-3	+1	-5	+1	-3	-1	+6	+1	-6	-5	-99
	Kent/Des Moines SR 99 East Station	+7	-3	+1	-1	+1	+1	+13	—	-9	+2	+2	-1	+8	+17	-27
Landfill Median Alignment Option		—	-1	+1	—	—	—	—	—	—	—	—	-1	+1	—	+1
Federal Way City Center Station Options	Federal Way I-5 Station	+2	—	—	-1	—	-3	+5	-1	—	+1	+1	-4	+6	-5	—
	Federal Way S 320th Park-and-Ride Station	-3	—	-1	+1	—	-3	-2	—	+1	+1	—	-1	-2	-20	+19
SR 99 to I-5 Alternative		**120**	**18**	**6**	**6**	**3**	**35**	**16**	**10**	**10**	**14**	**2**	**83**	**37**	**43**	**106**
S 216th Station Options	216th West Station	+6	—	—	-1	—	-2	+4	—	—	+4	+1	+1	+5	+13	—
	216th East Station	+5	-1	—	+4	+1	-1	+3	—	—	-1	—	+1	+4	+2	+26
Landfill Median Alignment Option		—	-1	+1	—	—	—	—	—	—	—	—	-1	+1	—	+1
Federal Way City Center Station Options	Federal Way I-5 Station	+2	—	—	-1	—	-3	+5	-1	—	+1	+1	-4	+6	-5	—
	Federal Way S 320th Park-and-Ride Station	-3	—	-1	+1	—	-3	-2	—	+1	+1	—	-1	-2	-20	+19

TABLE 4.1-2
Number of Potential Parcels Affected and Displacements by Alternative

Alternative		Number of Parcels Affected	Single-Family		Multi-Family		Commercial and Industrial		Public and Institutional		Vacant		Total		Displacements	
			Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Partial	Full	Business	Residential
I-5 to SR 99 Alternative		**341**	**16**	**11**	**22**	**17**	**134**	**34**	**27**	**17**	**47**	**16**	**246**	**95**	**98**	**244**
S 260th Station Options	S 260th West Station	-14	—	—	—	—	-22	+7	-1	-1	—	+3	-23	+9	+11	—
	S 260th East Station	-6	—	—	—	—	-8	+9	-3	—	-6	+2	-17	+11	+21	+3
S 272nd Redondo Trench Station Option		-21	+2	+4	+2	—	-24	+6	-5	—	-10	+4	-35	+14	—	+4
Federal Way SR 99 Station Option		-8	—	—	—	—	-13	+4	-2	—	+3	—	-12	+4	-13	—

Road widening would require minor, partial acquisitions affecting three churches, a childcare center, the Woodmont Public Library, and Federal Way High School. Buildings on these properties would not be affected. Impacts on these resources are further discussed in Section 4.4, Social Impacts, Community Facilities, and Neighborhoods; and Section 4.14, Public Services.

S 216th West Station Option

The potential additional station at S 216th Street (West option) would result in 6 additional commercial properties impacted with 13 additional business displacements. The increase primarily results from additional properties needed to build the station. No additional residential displacements would occur with this station option.

S 216th East Station Option

The potential additional station at S 216th Street (East option) would result in 5 additional properties impacted and 26 additional residential displacements from a mobile home park. This shift would displace 3 businesses, but would also avoid 1 business displacement from the SR 99 Alternative.

Kent/Des Moines HC Campus Station Option

The Kent/Des Moines HC Campus Station Option would avoid several businesses along SR 99, impacting fewer commercial properties with 7 fewer business displacements. This option would affect 19 more properties than the SR 99 Alternative, resulting in 18 additional single-family residential displacements and 1 mobile home park.

If this station option were selected in combination with the S 216th West Station Option, it would result in 23 more properties affected than the SR 99 Alternative, with 9 more business displacements and 44 more residential displacements. This combination of options would result in the largest increase in affected properties.

Kent/Des Moines SR 99 Median Station Option

This option would result in 2 additional business displacements. The station location would acquire 1 additional multi-family property, resulting in 14 additional residential displacements.

Kent/Des Moines SR 99 East Station Option

The Kent/Des Moines SR 99 East Station Option would avoid several properties on the west side of SR 99 but would impact additional properties on the east side. It would affect 9 fewer properties than

the SR 99 Alternative and displace 1 less business because more of the acquisitions are partial. It would result in full property acquisitions of 2 mobile home parks, resulting in an overall increase of 34 additional residential displacements, more than any other option.

S 260th West Station Option

The potential additional station at S 260th Street (West option) would reduce the number of properties affected by 15, but would change several partial acquisitions to full acquisitions, resulting in 18 additional business displacements. No additional residential displacements would occur with this station option.

S 260th East Station Option

The potential additional station at S 260th Street (East option) would impact 6 fewer parcels overall, but would change several partial acquisitions to full acquisitions, resulting in 21 additional business displacements and 3 additional residential displacements. This option would result in the greatest increase in business displacements of any option.

S 272nd Redondo Trench Station Option

The S 272nd Redondo Trench Station Option would affect 21 fewer properties and have no additional business displacements. Four additional single-family properties would be acquired and displaced.

Federal Way SR 99 Station Option

The Federal Way SR 99 Station Option would impact 8 fewer properties. It would result in 13 fewer business displacements and no additional residential displacements.

I-5 Alternative

The I-5 Alternative would require property acquisition from 163 properties, resulting in displacement of 285 residences and 29 businesses. The majority of the residential displacements would occur at multi-family residences, with impacts affecting part of 3 large apartment or condominium complexes and 2 smaller apartment complexes north of Kent-Des Moines Road and 1 smaller apartment complex and 2 mobile home parks in the Kent/Des Moines station area. The I-5 Alternative would generally be located in WSDOT right-of-way south of Kent-Des Moines Road, reducing the overall number of properties affected

A total of 29 businesses would be displaced from both single-use properties and business complexes.

Forty-nine properties categorized as "public/institutional" would be impacted, but most of these properties were acquired by WSDOT for the SR 509 extension project or are owned by public utilities, and are primarily vacant. The exceptions to this are the Park of the Pines Church and Conference Center, and Mark Twain Elementary School (see Section 4.17 Parkland and Open Space, Chapter 5 Construction, and Appendix E Section 4(f) Evaluation for more information on impacts on this resource).

Kent/Des Moines At-Grade Station Option

The I-5 Kent/Des Moines At-Grade Station Option would affect five fewer properties than the I-5 Alternative. This station would be located on currently vacant land, resulting in 5 fewer business and 99 fewer residential displacements, mostly due to the avoidance of 3 multi-family properties.

Kent/Des Moines SR 99 East Station Option

The I-5 Kent/Des Moines SR 99 East Station Option would affect 7 additional properties compared to the I-5 Alternative, resulting in 17 additional business displacements. Although it would acquire the same number of multi-family residential properties, the properties acquired for this option have fewer units, and therefore, it would result in 27 fewer residential displacements than the I-5 Alternative. One of these properties would be a mobile home park. This option would result in the largest number of business displacements.

Landfill Median Alignment Option

The I-5 Landfill Median Alignment Option would acquire different parcels but would not result in any change in the number of parcels acquired or business displacements because the I-5 Alternative alignment in this area is already located mostly within WSDOT right-of-way. It would change one partial residential acquisition to a full acquisition to provide emergency access, resulting in one additional residential displacement.

Federal Way I-5 Station Option

The Federal Way I-5 Station Option would impact 2 additional properties compared to the I-5 Alternative; however, the properties affected by this option contain fewer business and therefore this

option would result in 5 fewer business displacements and no additional residential displacements.

Federal Way S 320th Park-and-Ride Station Option

The Federal Way S 320th Park-and-Ride Station Option would impact 3 fewer properties than the I-5 Alternative station. It would use an existing park-and-ride for the station and would reduce business displacements by 20. However, the tail track needed at the station would require a partial acquisition of a mobile home park, resulting in 19 additional residential displacements.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would affect the fewest parcels because it would be mostly along I-5 within WSDOT right-of-way.

The SR 99 to I-5 Alternative would require property acquisition from 120 properties, resulting in displacement of 106 residences and 43 businesses. Residential displacements would mostly occur at multi-family residences. A total of 43 businesses would be displaced from both single-use properties and business complexes.

The impacts resulting from the station and alignment options for the SR 99 to I-5 Alternative would be the same as discussed above under the SR 99 Alternative (S 216th station options) and the I-5 Alternative (Landfill Median Alignment Option and Federal Way city center station options).

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would result in the greatest number of property acquisitions and total displacements (business and residential combined). The I-5 to SR 99 Alternative would require property acquisition from 341 properties, displacing 244 residences and 98 businesses. Of the 341 properties affected, 66 are residential: 27 are single-family and 39 are multi-family properties. A total of 98 businesses would be displaced from both single-use properties and business complexes.

The impacts resulting from the station and alignment options for the I-5 to SR 99 Alternative would be the same as discussed above under the SR 99 Alternative (S 260th East Station Option and S 272nd Redondo Trench Station Option) and the I-5 Alternative (Federal Way SR 99 Station Option). However, the impacts from the S 260th West Station Option would be slightly less than with the SR 99 Alternative because the I-5 to SR 99 Alternative does not enter the SR 99 corridor

until approximately S 246th Street. Several parcels are partial acquisitions instead of full. This option would have 11 more business displacements than the I-5 to SR 99 Alternative, but 7 fewer business displacements than the S 260th West Station Option when it is associated with the SR 99 Alternative.

Indirect Impacts

The project's property impacts resulting from acquisitions, displacements, and relocations would be direct. There could also be indirect impacts associated with the change in land use, as a property is converted to a transportation use. Some acquired property could also accommodate transit-oriented development (TOD), consistent with Sound Transit policy and local planning requirements. However, TOD and land use changes would not result in additional acquisitions. The potential impacts from land use change and TOD are discussed in Section 4.2, Land Use.

4.1.5 Relocation Opportunities

To measure opportunities for new locations for displaced businesses and residents, Sound Transit researched available residential and commercial real estate in the FWLE vicinity, generally defined as including SeaTac, Des Moines, Kent, and Federal Way. Some additional areas in south King County, such as Tukwila and Renton, were also included. Although property availability will change over time, there are numerous opportunities for residents and businesses to relocate within the FWLE vicinity, which would minimize difficulties in adjusting to relocation. Some affected properties with unique characteristics (such as a church or a property with school district uses) could prove more challenging to relocate.

The relocation of a business or residence is an inconvenience or hardship for those involved. Sound Transit would offer relocation assistance that includes compensation as well as supporting services that consider the unique needs of those being relocated, and this assistance can help reduce inconveniences or hardships. Sound Transit is also required to satisfy federal requirements for residential relocation, which define a "comparable replacement dwelling" as any dwelling that is: (A) decent, safe, and sanitary; (B) adequate in size to accommodate the occupants; (C) within the financial means of the displaced person; (D) functionally equivalent; (E) in an area not subject to unreasonable adverse environmental conditions; and (F) in a location generally not less desirable than the location of the

displaced person's dwelling with respect to public utilities, facilities, services, and the displaced person's place of employment (42 *United States Code* [USC] 61). To meet these requirements, Sound Transit may identify relocation properties that are in better condition and of higher value than the properties being acquired, in which case tenants may be eligible for a rent supplement as described in Section 4.1.6.

4.1.5.1 Office

A sufficient number of office buildings is available for sale each year to replace the projected displaced buildings. A substantial amount of space is also available for lease each year to meet the needs of displaced office tenants. In addition, vacant land and underutilized properties are available for the construction of new office buildings, which could provide additional capacity. Table 4.1-3 summarizes the vacancy rates of different types of commercial property in the FWLE vicinity.

TABLE 4.1-3
Commercial Property Vacancy in the FWLE Vicinity

Commercial Property Type	Vacancy Rate[a]
Office	11.9%
Retail	6.4%
Industrial	4.6%

Source: NAI Puget Sound Properties, 2014.

[a] Vacancy rates listed here are for the south end of Puget Sound, which includes the cities of Des Moines, Federal Way, SeaTac, and Kent. The south end also includes additional nearby cities such as Renton and Tukwila.

4.1.5.2 Retail

There is enough retail space for sale and for lease to meet the relocation needs of retailers displaced by the FWLE. Sound Transit would perform a case-by-case assessment to understand how the available inventory could meet the displaced retailer's specific needs. Although the information provided in Table 4.1-3 is based on the south Puget Sound area, visits to the FWLE area confirm that there is an adequate amount of vacant retail space. Additionally, a search for retail space for lease in the FWLE vicinity revealed approximately 1.5 million square feet of retail space available (CoStar, 2014).

4.1.5.3 Hotels

Displaced hotel property owners would have to locate a property that is for sale or locate a substitute site to construct a new hotel. The

study area has approximately 20 hotels, generally located along the SR 99 corridor. The SR 99, SR 99 to I-5, and I-5 to SR 99 alternatives would displace three hotels, while the I-5 Alternative would displace two hotels. Although hotel properties do come up for sale, location requirements and physical characteristics of the displaced property are usually unique and it can be difficult to find an available property that meets all of the desired features. New development sites exist and may provide the best opportunity for replacement.

4.1.5.4 Industrial

Adequate industrial space is available in the market to meet the needs of the few light-industrial building owners and tenants that could be displaced by the FWLE.

4.1.5.5 Owner-Occupied Residences

Relocation sites for owner-occupied residences (single-family and multi-family) are expected to be readily available in the same general area, but not necessarily in the same neighborhood. According to the Northwest Multiple Listing Service (MLS), over 1,000 residences (including approximately 200 condominiums and 40 mobile homes) were for sale in SeaTac, Des Moines, Kent, and Federal Way in November of 2014 (MLS, 2014).

The number of owner-occupied residences to be acquired in each area is relatively small in proportion to the entire housing stock. A sufficient supply of comparable relocation housing is expected to be available within the study area; however, depending on market conditions, reasonably priced, similar replacement property may be limited. Sound Transit would provide relocation assistance and compensation.

4.1.5.6 Renter-Occupied Residences

A sufficient supply of comparable relocation housing is expected to be available within the study area; however, depending on market conditions, reasonably priced, similar replacement property may be limited. Sound Transit would provide relocation assistance and compensation as described above. Table 4.1-4 summarizes the total number of housing units and estimates the available rental units in the FWLE vicinity.

TABLE 4.1-4
Estimated Available Rental Units in the FWLE Vicinity

Area	Vacancy Rate	Total Renter-Occupied Housing Units	Approximate Number of Available Units
Kent	6.8%	20,633	1,400
SeaTac	4.3%	4,709	200
Des Moines	5.0%	4,834	240
Federal Way	7.3%	14,912	1,090
Total units in FWLE vicinity		45,088	2,930

Source: American Community Survey, 2013.

4.1.6 Sound Transit Acquisition and Relocation Policy Summary

Sound Transit has notified property owners whose property may be directly affected by any of the alternatives, but acquisition of property would begin only after the environmental process is complete and the Sound Transit Board selects the project to be built. The tables and maps in Appendix D4.1 identify each potentially affected parcel. As described in Section 2.8, Next Steps and Schedule, there are a number of steps that Sound Transit will go through before property acquisition will begin as part of final design. Sound Transit will continue to communicate with property owners during the Final EIS, the Sound Transit board decision process on the project to be built, and final design. As described in Section 2.6, Interim Terminus Stations, the project may be constructed in phases and therefore acquisition of properties south of the Kent/Des Moines Station could be delayed from the schedule shown in Exhibit 2-28.

Sound Transit relocation staff are available to answer questions and provide additional information about relocation assistance services, payments, reimbursement eligibility, and the timing of the process. Qualified relocation agents from Sound Transit would determine the relocation needs and preferences of each household, business, and organization to be displaced. They would work closely and proactively with residents and businesses to help them plan ahead for relocation, and would assist in finding new homes or sites, and help to solve problems that might occur. While the ultimate choice of relocation site would be up to the affected resident or business, the agency would help investigate possible locations, including nearby properties. Sound Transit uses interpreters to help those with limited English proficiency understand their choices and options.

Owners would not have to relocate until they have been paid the agreed purchase price or until an amount equal to Sound Transit's estimate of just compensation has been deposited with the court. Residents, businesses, and tenants would not have to relocate without receiving at least 90 days written notice. Given the uncertainty about which alternative will be selected to be built, it is generally recommended that property owners proceed with planned improvements to their properties or facilities as they deem necessary at this time. Property owners would be offered just compensation for their land and improvements as described below.

A public agency must pay "just compensation" to property owners for land and improvements acquired for public purposes. "Just compensation" must not be less than the fair market value of the property acquired. It includes any measurable loss in value to the remaining property as a result of a partial acquisition. For instance, Sound Transit would mitigate for the permanent loss of parking spaces resulting from partial property acquisition by compensating the property owner or by providing replacement parking.

Sound Transit would pay for normal expenses of sale, including escrow fees, title insurance, prepayment penalties, mortgage release fees, recording fees, and typical costs incurred as part of conveying title.

Relocation benefits are dependent on individual circumstances. Examples of factors that can affect relocation benefits include the condition of the replacement property, time of occupancy at the displaced property, and age or condition of a mobile home.

Depending on individual circumstances, Sound Transit might pay for residential moving expenses and replacement housing payments, nonresidential moving expenses, business reestablishment expenses, and other eligible expenses. Sound Transit's residential and non-residential acquisition and relocation handbooks (Sound Transit, 2013b and c) detail the compensation and acquisition procedures. These are available at http://www.soundtransit.org/Documents/pdf/projects/Prop%20Acq%20and%20Res%20Relo%20Hndbk%2012-2013.pdf and http://www.soundtransit.org/Documents/pdf/projects/Prop%20Acq%20and%20Non-Res%20Relo%20Hndbk%2012-2013.pdf, respectively.

Tenants may be eligible for rent supplements if comparable decent, safe, and sanitary replacement housing is more than their current rental cost. In these cases, Sound Transit would pay the difference, or a portion of the difference, between the tenant's current and new rental rates for a 3.5-year period (42 months).

Sound Transit follows Title 49 Part 24, Subpart F for relocation of mobile home owners and tenants. Assistance would vary depending on individual circumstances. Mobile home residents are eligible for the same acquisition and relocation benefits that apply for other residential properties. Some residents own their mobile home, but rent or lease space in a mobile home park. In these cases, the residents would receive rental relocation assistance and their mobile home would be relocated. If the mobile home could not be relocated because of its age or condition, the owner would receive rental relocation assistance, but would also be compensated for their mobile home. They could then choose to use this payment for purchase of another mobile home or other real estate (for example, a down payment for a single-family home or condominium). Other mobile home residents rent both the space in a mobile home park and the mobile home unit. These residents would be eligible for rental relocation assistance, similar to someone renting an apartment or house. Still others may own land with a mobile home. They would receive payment for the land in addition to payment for the mobile home, the same as other residential land acquisition.

If Sound Transit recognizes special circumstances, proactive help to solve problems would be available.

4.1.7 Potential Mitigation Measures

As part of the FWLE and as noted above, Sound Transit would compensate affected property owners according to the provisions specified in Sound Transit's adopted Real Estate Property Acquisition and Relocation Policy, Procedures, and Guidelines (Resolution #R98-20-1; Sound Transit, 1998). Sound Transit would comply with provisions of the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 CFR, Part 24), as amended, and the State of Washington's relocation and property acquisition regulations (WAC 468-100 and RCW 8.26). Benefits would vary depending on the level of impact, available relocation options, and other factors. Because of these compliance actions, no additional mitigation would be necessary.

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4.2 Land Use

4.2.1 Summary

High-capacity transit (HCT) has been studied and planned for by regional and local agencies in the Federal Way Link Extension (FWLE) corridor for over 30 years. Local jurisdictions have planned for the project in their comprehensive plans and have adopted zoning that provides for potential future land uses that are generally consistent with light rail and associated stations. Direct land-use impacts would occur from conversion of public and private property to transportation uses and are described in further detail in Section 4.2.4.2. Table 4.2-1 shows predominant land uses that would be converted to transportation use for each FWLE build alternative and the total acres of land that would be converted. The alternatives would convert approximately 41 to 80 acres of land to transportation uses, with the SR 99 to I-5 Alternative converting the least and the SR 99 Alternative with the additional stations options converting the most. All build alternatives would generally run adjacent to or within existing transportation rights-of-way and therefore are consistent with existing adjacent land uses. Much of the land along the SR 99 corridor is currently considered underutilized (built at uses less dense than allowed under current zoning), and the addition of the FWLE in this area would support redevelopment in this corridor in accordance with current zoning.

Redevelopment of land around stations could occur as an indirect effect of the FWLE. Often referred to as transit-oriented development (TOD), these potential changes in land use and the timing for such redevelopment depends on land availability, zoning regulations, market conditions, and several other factors. TOD could occur on surplus property originally acquired for construction of the project but no longer needed (e.g., staging areas acquired outside of highway right-of-way). TOD could also occur in a larger area surrounding or in proximity to light rail stations. A separate study of TOD potential at station locations has been completed for the FWLE (Sound Transit, 2015) and is available at http://www.soundtransit.org/Projects-and-Plans/Federal-Way-Link-Extension/Federal-Way-document-archive. Results of this assessment are summarized in this section.

TABLE 4.2-1
Predominant Existing Land Uses Converted to Transportation Use

Alternative	Predominant Land Uses	Acres Converted to Transportation Use (Range with Options)
SR 99 Alternative	Commercial, Institutional, Vacant	**50.9** (48.9-80.4)
I-5 Alternative	Vacant, Commercial, Multi-Family	**47.7** (46.6-54.5)
SR 99 to I-5 Alternative	Commercial, Vacant, Multi-Family	**41.7** (41.3-56.3)
I-5 to SR 99 Alternative	Commercial, Institutional, Vacant	**54.7** (54.7-71.1)

Appendix D4.2 summarizes relevant land use plans, goals, and policies.

4.2.2 Introduction to Resources and Regulatory Requirements

This section provides information on the existing land uses and current zoning (future allowable land uses), describes changes in land use that would occur as a result of the FWLE, and evaluates the consistency of the project with local and regional planning policies.

Local jurisdictions address HCT in comprehensive plans and other planning documents, and in some locations the potential for HCT is reflected in future land-use designations. Specifically, Des Moines' *Comprehensive Transportation Plan* (City of Des Moines, 2012a), Kent's *Midway Subarea Plan* (City of Kent, 2011a), and the *Federal Way Comprehensive Plan* (City of Federal Way, 2012) anticipate development of HCT in the project corridor. In addition, regional plans such as Puget Sound Regional Council's (PSRC) *Vision 2040* (PSRC, 2009) and *King County Metro Transit Strategic Plan for Public Transportation 2011 to 2021* (King County Metro, 2011) have identified future HCT in the FWLE corridor. Sound Transit's Regional Transit Long Range Plan (Sound Transit, 2005) identifies HCT between S 200th Street in SeaTac and the Federal Way city center, and the Sound Transit 2 Plan (ST2; Sound Transit, 2008) included the extension from the S 200th Street light rail station to S 272nd Street in the city of Federal Way. These local and regional plans identify the need to connect the urban centers with HCT to allow for more efficient use of land and as a sustainable alternative to increasing traffic congestion problems.

TOD is a pattern of dense, mixed-use, pedestrian-friendly land uses located near transit nodes such as light rail stations. TOD could occur in station locations where jurisdictions have provided for greater density and mixture of uses in their comprehensive plans and zoning regulations.

The FWLE's land-use compatibility and conformance with existing land-use policies and plans was evaluated based on review of the plans listed in Table 4.2-2. Appendix D4.2, Land Use, evaluates the FWLE for consistency with those plans and policies.

TABLE 4.2-2
Adopted Plans and Policies

Washington State
Growth Management Act (GMA; Revised Code of Washington [RCW] 36.70A.200, adopted 1990, as amended)
Puget Sound Regional Council
VISION 2040 (2009)
Transportation 2040: Toward a Sustainable Transportation System (2014)
Sound Transit
Regional Transit Long-Range Plan (20014)
Sound Transit 2: A Mass Transit Guide; The Regional Transit System Plan for Central Puget Sound (ST2) (2008)
King County
King County Metro Transit Strategic Plan for Public Transportation 2001-2021 (2011)
King County Comprehensive Plan (adopted 2012)
City of SeaTac
City of SeaTac Comprehensive Plan (adopted December 1994, updated 2012)
City of Des Moines
City of Des Moines Comprehensive Plan (adopted 2009, amended 2012)
City of Kent
City of Kent Comprehensive Plan (adopted 2004, amended 2011)
Midway Subarea Plan (adopted December 2011)
City of Federal Way
City of Federal Way Comprehensive Plan (adopted 1995, revised 2013)

4.2.3 Affected Environment

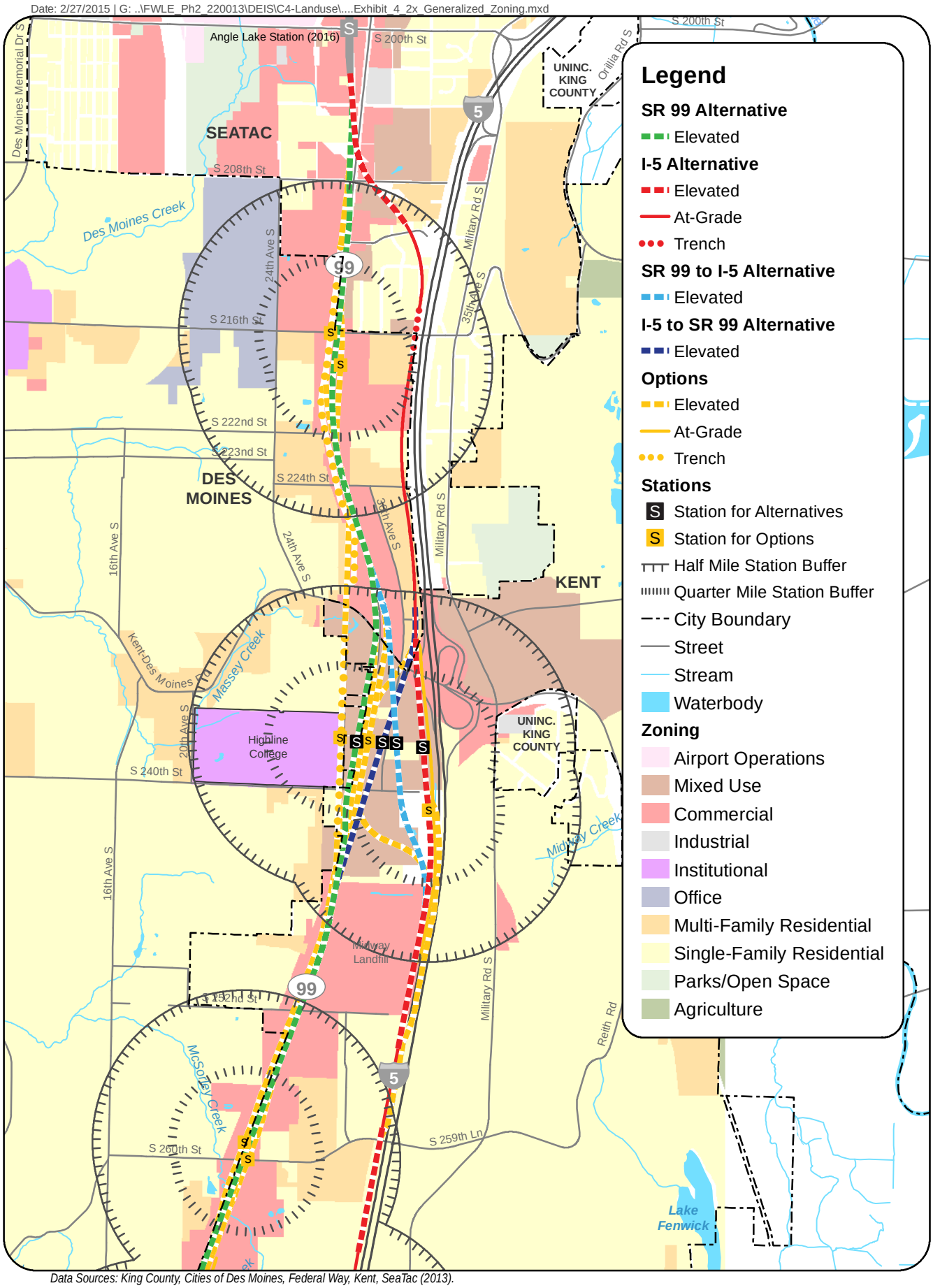
The land-use study area for FWLE consists of the areas immediately adjacent to the project alignments and the land uses within a 0.5-mile radius around the potential stations. Land uses in the areas within 0.5 mile of the potential stations have the greatest probability of being affected, both directly and indirectly. The FWLE would be

located within the urban growth boundary of southwest King County, and the FWLE alternatives would travel through and within the urbanized cities of SeaTac, Des Moines, Kent, and Federal Way. The SR 99 and I-5 corridors generally travel parallel to each other in the FWLE study area and are less than one mile apart. Since these corridors are close to each other the potentially affected area east of SR 99 and west of I-5 overlap. Likewise, the 0.5-mile study area around some of the station areas overlap.

The following subsections describe existing and potential future land uses in each city and summarize overarching land-use policies in the SR 99 and I-5 corridors as they relate to the FWLE. All land uses have been generalized into dominant land-use categories (single-family residential, multi-family residential, commercial, institutional, mixed-use, parks/open space, industrial, office, and vacant) so that the land use could be presented consistently across jurisdictions, to the extent possible. Potential future land uses were defined by generalizing each city's zoning and reviewing city ordinances. Generalized zoning is shown in Exhibits 4.2-1 and 4.2-2 for areas within 0.25 mile and 0.5 mile of stations, and is consistent with applicable comprehensive plans. Exhibit 4.2-3 compares the existing land uses with the future allowable land uses (generalized zoning) at each potential station area (including all station options) and indicates where zoning represents a potential future land-use change. The percentages of land use shown in Exhibit 4.2-3 are estimates of the amount of land within 0.5 mile and 0.25 mile of stations. Section 4.3, Economics, includes information on projected households and employment within 0.5 mile of the stations.

4.2.3.1 FWLE Corridor

The SR 99 corridor has similar land uses from north to south and land use does not vary greatly by city boundaries. Land uses immediately adjacent to SR 99 are predominantly commercial uses, including hotel/motels, automotive services, small-scale strip malls, office uses, retail commercial, larger big-box retail commercial, medical facilities, and restaurants. Land uses transition to single-family and multi-family residential west and east of the commercial corridor. Some public and quasi-public uses (e.g., churches and a park) are located between I-5 and SR 99. In addition, there is one large institutional use (Highline College) west of SR 99, and there are some industrial land uses adjacent to the corridor and pockets of vacant land.



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.2-1
Generalized Zoning (North)

Federal Way Link Extension

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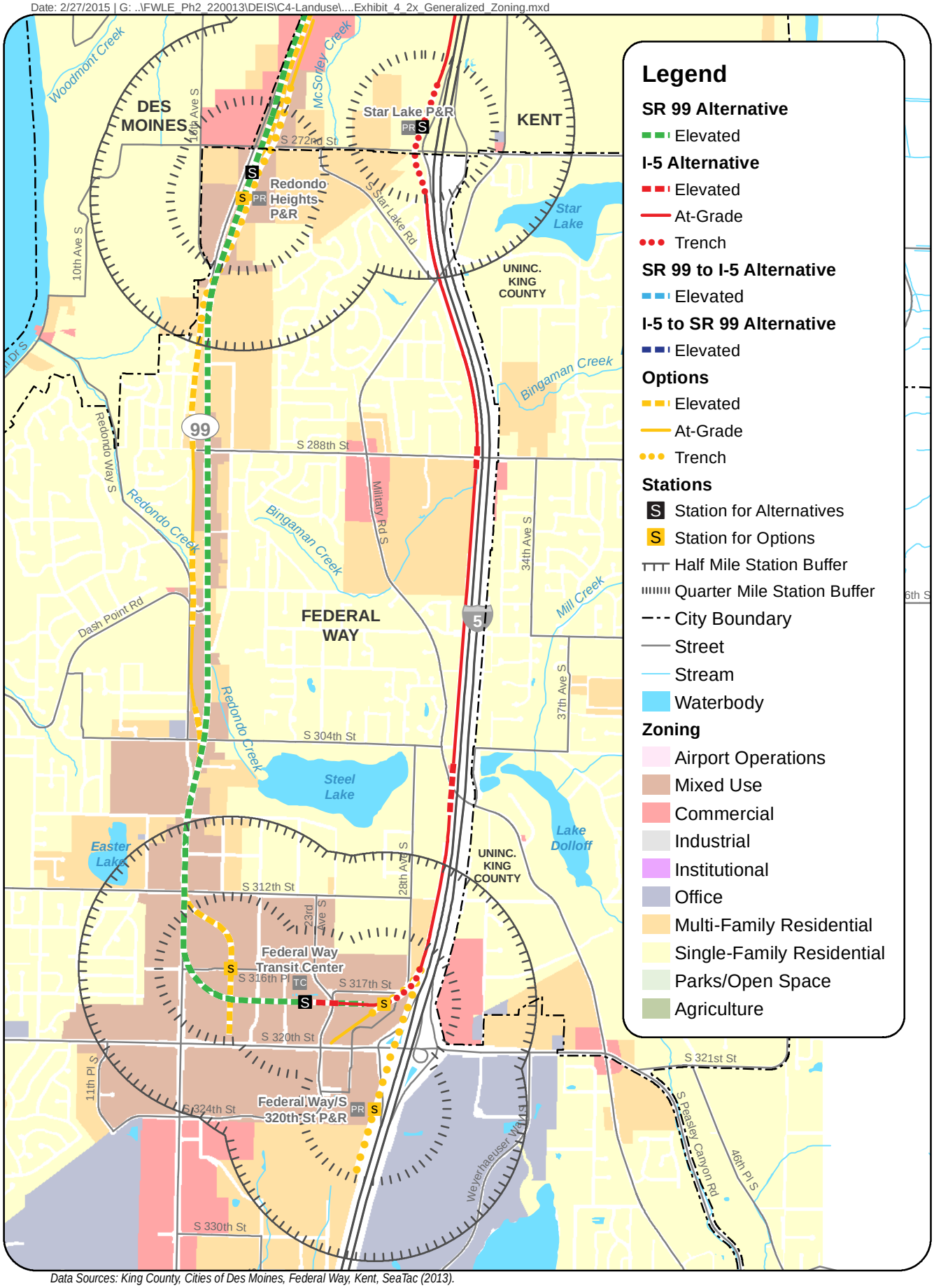


Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.2-2
Generalized Zoning (South)
Federal Way Link Extension

	Land Use Within 1/4 Mile	Land Use Within 1/2 Mile
S 216th Street Stations		
Existing Land Use	20% 30% 30% <10% 10% 10%	30% 20% 20% 10% 20%
Allowable Future Land Use	20% 20% 10% 50%	30-40% 10-20% 10% 30% 10-20%
Kent/Des Moines Stations		
Existing Land Use	20% 10% 40% 20% 10%	20% 10% 30% 20% 20%
Allowable Future Land Use	20% 50% 10% 20%	20% 10% 30% 20% 20%
S 260th Street Stations		
Existing Land Use	10% 20% 30% 10% 30%	40% 10% 20% 30%
Allowable Future Land Use	30% 20% 50%	60% 10% 30%
S 272nd Street Stations		
Existing Land Use	0-20% 20-40% 10-40% 10% 10-40%	30% 20% 10% 10% 30%
Allowable Future Land Use	10-70% 30-40% 0-40% 0-10%	50-70% 10-30% 10% 10%
Federal Way Transit Center Stations		
Existing Land Use	0-10% 10% 40-80% 0-10% 0-10% 0-10% 10%	10% 10-20% 40-50% 10% 10% 10%
Allowable Future Land Use	0-10% 0-10% 50-100% 0-10% 0-20%	10-20% 10-20% 30-60% 10% 10-30%

Legend: Single-Family; Multi-Family; Mixed Use; Commercial; Office; Parks; Institutional; Industrial; Vacant/Other

EXHIBIT 4.2-3
Existing Land Uses and Allowable Future Land Uses around Station Areas

Note: Station information is generalized for multiple station options in the same area and represents all alternatives.

The I-5 corridor is mostly surrounded by residential land uses. South of S 272nd Street, the eastern portion of the I-5 corridor is in unincorporated King County. This area is primarily suburban single-family residential uses and much of the area is zoned for single-family residential with some small pockets of commercial and multi-family residential (see Exhibit 4.2-3). As noted in Section 4.2.3.1, the west side of the I-5 corridor overlaps with much of the east side of the SR 99 corridor. Adjacent to the west side of I-5, single-family and multi-family residential uses are predominant, with commercial land uses further west near SR 99.

4.2.3.2 Land Use by City

City of SeaTac

The Seattle-Tacoma International Airport (Sea-Tac) is the Northwest region's largest international airport. Although the airport is outside of the study area, it has played an important role in land-use development along the SR 99 corridor in SeaTac, which includes a number of commercial uses that cater to the airport such as motels/hotels, restaurants, and gas stations. The area between SR 99 and I-5 is dominated by commercial uses in the north and several former residential and commercial properties acquired by Washington State Department of Transportation (WSDOT) for the SR 509 extension project that are now vacant. South of this area is predominantly single-family residential land uses.

The *City of SeaTac Comprehensive Plan* (City of SeaTac, 2012) identifies a planned future light rail extension south of the Angle Lake Station. Although no stations for the FWLE are proposed in SeaTac, the potential additional station at S 216th Street would be near the boundary between Des Moines and SeaTac, and development of this station could affect land use in SeaTac. This area is planned for mixed use in the future along SR 99, but otherwise would remain commercial and single-family residential, as shown in Exhibit 4.2-1.

City of Des Moines

The area the west of SR 99 in Des Moines is single-family and multi-family residential with some commercial development, and also includes Highline College. The area between SR 99 and I-5 is known as Pacific Ridge. This area is currently single- and multi-family residential and commercial; however, the Pacific Ridge Element of the *City of Des Moines Comprehensive Plan* (City of Des Moines, 2012b) calls for higher-density development to utilize regional transportation links. The comprehensive plan calls for increased building heights in Pacific

Ridge to enhance land value, promote redevelopment and job growth, expand view opportunities, and accommodate household growth targets.

As shown in Exhibit 4.2-1, potential future land uses adjacent to SR 99 include commercial and mixed use with single- and multi-family residential uses farther east and west. This is generally consistent with existing land uses, although zoning allows for higher-density development than currently exists.

The Kent/Des Moines SR 99 West Station would be located in Des Moines, as would the HC Campus Station Option. The remaining Kent/Des Moines station options would be located in the city of Kent, but much of the area within 0.5 mile of these stations would be in the city of Des Moines.

City of Kent

Most of the study area within the city of Kent is within the Midway Subarea, located between SR 99 and I-5 south of Kent-Des Moines Road. The Midway Subarea land use is currently low-density commercial and residential. Commercial uses in the city of Kent include larger retail stores than those generally found elsewhere in the corridor, such as Lowe's and Fred Meyer. The study area includes the decommissioned 60-acre Midway Landfill. Most of the area between S 260th Street and S 272nd Street is McSorley Creek Wetlands, much of which has been acquired by the city for preservation.

The *Midway Subarea Plan* adopted in December 2011 by the City of Kent updated and created new policies, land-use designations, and zoning in anticipation of light rail in this area. The Subarea Plan encourages transition from the existing land uses to denser mixed-use development. Within the project corridor, land uses in this subarea are planned to result in the greatest amount of change in density and mixed uses over time from the existing pattern of uses. As shown in Exhibits 4.2-1 and 4.2-2, potential future land uses in the Midway Subarea and within 0.5 mile of the Kent/Des Moines Station include mixed-use, multi-family residential, and commercial.

Star Lake Park-and-Ride is located west of I-5, just north of S 272nd Street. The S 272nd Star Lake Station at the Star Lake Park-and-Ride is surrounded by single-family residential and multi-family residential land uses. Potential future land uses within 0.5 mile of the station

include some mixed-use along SR 99, but otherwise would generally not change.

Beyond the station areas, potential future land uses include single-family land use on the east side of I-5 and a mix of commercial, single-family, and mixed-use on the west side of I-5. With the exception of the mixed-use area, future land-use designations are generally consistent with existing land uses.

City of Federal Way

The FWLE would enter the city of Federal Way at S 272nd Street. Redondo Heights Park-and-Ride is located on the east side of SR 99 in Federal Way. Existing land uses south of S 272nd are predominantly single-family residential, but also have commercial and multi-family uses along the SR 99 corridor. The Federal Way Transit Center is located between SR 99 and I-5 in the Federal Way City Center, an area dominated by larger commercial retail uses including the "Commons" mall and big box retail, some of which are vacant. The area also includes the Federal Way S 320th Street Park-and-Ride.

The City Center element of the *City of Federal Way Comprehensive Plan* (City of Federal Way, 2013) was planned to support regional HCT and to reduce dependency on automobiles. This plan envisions a HCT stop in the City Center surrounded by mixed-use.

As shown in Exhibit 4.2-2, potential future land uses along SR 99 include mixed use and multi-family residential uses, which is a change over existing conditions. Potential future land uses along I-5 are generally single-family residential with some multi-family residential land uses. Potential future land uses within 0.5 mile of the S 272nd Street Station at the Redondo Heights Park-and-Ride include multi-family residential and mixed-use along SR 99. Further from SR 99, there are potential future single-family residential land uses around the station. Within the Federal Way City Center, which is located between S 312th and S 324th streets and includes much of the area within 0.5 mile of the Federal Way stations, the potential future land use is mixed-use. Further away from this station, potential future land uses include commercial, single-family residential, multi-family residential, and parks/open space.

4.2.4 Environmental Impacts

This section discusses the consistency of the alternatives with regional, state, and local land-use policies and the direct and indirect impacts on existing and allowable future land uses.

4.2.4.1 No Build Alternative

The No Build Alternative includes the existing transportation system and future population and employment growth assumed in adopted plans, but without the Federal Way Link Extension. It would not displace any residents or businesses. However, this alternative is inconsistent with many of the regional land-use and transportation policies because it would not develop a HCT system connecting the region's highest-growth centers, nor is it consistent with the local plans that encourage increased density and/or TOD land-use patterns in anticipation of HCT service. The PSRC policies related to focused and compact growth, frequent transit service, connecting urban centers, and transportation alternatives to the single-occupant vehicle would be either not fully implemented or only partially implemented. Therefore, the No Build Alternative would constrain transportation options, leading to more traffic congestion where higher density land uses are planned and could slow the rate of denser development in growth centers.

4.2.4.2 Build Alternatives

The following subsections describe the direct and indirect impacts of the build alternatives. Construction impacts related to land use are discussed in Chapter 5, Construction Impacts.

Direct Impacts

Impacts Common to All Alternatives

Consistency with Land-use Plans and Policies

Regional, state, and local land-use plans in the study area share the goal of improving transit accessibility and encouraging transit use by concentrating mixed land uses within the project corridor in the areas that the jurisdictions have identified. The project would connect employment centers and provide for uninterrupted access among the four cities in the corridor.

Sound Transit reviewed regional, state, and local master plans to identify goals and/or policies applicable to the FWLE to determine whether the project is consistent with the applicable plans. Appendix D4.2 describes the consistency of the build alternatives with applicable plans and policies. The alignment and station alternatives are all generally consistent with regional plans and policies in the study area. The FWLE would comply with goals and polices identified in PSRC's *VISION 2040* by providing a regional transit system serving a growing transportation need for planned density of residential and

employment uses within designated urban areas. In addition, PSRC developed a corridor action strategy, *Growing Transit Communities Strategy* (PSRC, 2013), for several of the region's major transit corridors. The FWLE is in PSRC's South Corridor area and would contribute to meeting the objectives of its action strategy.

Local planning documents focus on the types of land uses permitted within zones and the scale of development that is allowed within these zones. The FWLE would increase transit level of service and linkages with other jurisdictions and regional destinations. Development around stations in lower-density residential areas is not expected to encourage incompatible commercial or office uses because the applicable plans and codes preclude such uses. In those areas where the local jurisdictions have adopted land-use plans, policies, and development regulations to facilitate higher density (including mid- and high-density mixed use of multi-family residential, commercial, and office development), the FWLE would be consistent with the goals and policies.

The jurisdictions have been planning for HCT in the study area as evidenced in their planning documents, including the Pacific Ridge Element of the *City of Des Moines Comprehensive Plan* (City of Des Moines, 2012b), Kent's *Midway Subarea Plan* (City of Kent, 2011a), and the City Center Chapter of the *City of Federal Way Comprehensive Plan* (City of Federal Way, 2013). As shown in Exhibits 4.2-1 and 4.2-2, most of the stations are surrounded by areas of planned commercial and mixed-use development. The comprehensive plans of all four cities in the study area support HCT in the corridor (see Appendix D4.2, Land Use, for a discussion of specific policies in each city related to land use, transportation, and economic development).

The Washington State Growth Management Act (GMA) requires that zoning be consistent with comprehensive plans and prohibits local governments from precluding the siting of essential public facilities through their comprehensive plans or zoning. The FWLE is a "regional transit authority facility" and is, therefore, explicitly recognized as an essential public facility in the GMA (RCW 36.70A.200). When Sound Transit's alignment decision has been finalized, affected jurisdictions have a "duty to accommodate" the FWLE in their land-use plans and development regulations.

Conversion of Land Uses to Transportation Uses

Direct land-use impacts would occur in locations where the FWLE would require private or public property acquisitions. Most of the property acquired would be permanently converted to a transportation-related use. The property acreage shown in Section 4.1, Acquisitions, Displacements, and Relocations, is greater because not all of the property acquired would be permanently converted to transportation uses. This would occur for staging areas and some properties where the light rail alignment bisects a large property that could later be redeveloped consistent with city zoning. Property that is already public right-of-way for transportation uses, such as the SR 99 median and I-5 right-of-way, are not included in this analysis because they are already dedicated to transportation uses.

The FWLE alternatives being considered generally follow existing transportation corridors, minimizing the amount of additional required right-of-way.

Table 4.2-3 shows the maximum amount of land that would be converted to a transportation-related use for the alternatives. The range of land converted with the options is shown in parentheses. The totals represent the amount of property that would be permanently required outside of existing public rights-of-way (including I-5, SR-99, and other roadways). Acres of land that would be converted to a transportation-related use for each station option are shown in Table D4.2-1 in Appendix D4.2.

The land to be acquired for the FWLE would constitute only a small portion, less than 0.2 percent, of the total amount of land in the four cities in the study area, and would not result in material changes in the regional or local land use or development patterns. However, there would be indirect TOD opportunities near the stations as described in “Indirect Impacts” below.

Impacts by Alternative

Direct impacts for each alternative and station option in terms of land acquisitions are shown in Table 4.2-3. The following discussion focuses on the differences in direct impacts from land conversion for each alternative, station, and station option.

TABLE 4.2-3

Potential Conversion of Existing Land Use to Transportation-Related Land Use (acres)

Alternative	Acres by Zoning Category (Range with Options)							Total Acreage Affected[a]
	Single-Family	Multi-Family	Commercial (includes Office)	Industrial	Institutional	Parks/ Open Space	Vacant	
SR 99 Alternative	**0.2** (0.2 to 2.6)	**2.0** (2.0 to 10.8)	**30.8** (27.5 to 46.0)	**0** (0 to 0.1)	**10.5** (10.2 to 14.2)	**0** (0)	**7.4** (7.1 to 14.7)	**50.9** (48.9 to 80.4)
I-5 Alternative	**6.7** (2.1 to 6.8)	**8.0** (2.8 to 9.1)	**12.7** (2.1 to 25.4)	**0** (0)	**5.5** (1.7 to 5.6)	**0** (0)	**14.8** (14.2 to 28.1)	**47.7** (46.6 to 54.5)
SR 99 to I-5 Alternative	**5.6** (5.5 to 5.7)	**6.0** (6.0 to 12.9)	**17.2** (7.9 to 30.1)	**0** (0)	**0.8** (0.8 to 1.1)	**0** (0)	**12.1** (11.5 to 25.1)	**41.7** (41.3 to 56.3)
I-5 to SR 99 Alternative	**1.3** (1.3 to 2.2)	**6.5** (6.5 to 6.7)	**26.2** (27.3 to 33.8)	**0** (0 to 0.1)	**11.5** (11.2 to 11.5)	**0** (0)	**9.2** (10.4 to 17.3)	**54.7** (54.7 to 71.7)

Note: Existing land-use types were developed using King County Assessor data. Acreage excludes planned staging areas and portions of parcels that are anticipated to be sold after construction is complete.

[a] Total acreage may be more or less than the sum of individual zoning categories due to rounding.

SR 99 Alternative

S 216th Station Options

The potential additional station at S 216th Street would result in additional land conversion when compared to the SR 99 Alternative. This would be due to the additional area needed for a station as well as the guideway traveling from the median of SR 99 to the side of the roadway (Table 4.2-3). Of the two station options, the S 216th West Station Option would result in a slightly larger conversion of land to a transportation-related use.

Kent/Des Moines Station Options

The Kent/Des Moines HC Campus Station Option would convert more land to a transportation use than the SR 99 Alternative, while the Kent/Des Moines SR 99 East and Median Station options would convert less land (Table 4.2-3). The Kent/Des Moines HC Campus Station Option would convert more institutional (college) land, as well as single-family and multi-family property adjacent to the college.

S 260th Station Options

The potential additional station at S 260th would shift the guideway from the SR 99 median to either the west or east side of SR 99 into an area with mostly commercial and vacant land uses. Since the S 260th Station would leave the SR 99 right-of-way, it would convert more adjacent land to a transportation use than the SR 99 Alternative. Of the S 260th station options, the S 260th West Station Option would convert the greatest amount of land to transportation use. Most of the land that would be converted would be either commercial or vacant.

S 272nd Redondo Trench Station Option

This station option would result in a greater amount of land use conversion than the SR 99 Alternative. Most of the land that would be converted would be either commercial or vacant.

Federal Way SR 99 Station Option

The Federal Way SR 99 Station Option would result in the conversion of more land to transportation use than the SR 99 Alternative. Most of the land that would be converted is commercial and vacant property in the Federal Way City Center.

I-5 Alternative

The I-5 Alternative would have less direct land-use impacts than the SR 99 Alternative. Much of the land that would be directly affected is currently vacant (Table 4.2-3). Some of this land is owned by WSDOT and is intended for future SR 509 improvements, which is a transportation use. Out of all of the alternatives, the I-5 Alternative would convert the most single- and multi-family property, concentrated north of Kent-Des Moines Road.

Kent/Des Moines Station Options

The Kent/Des Moines station options would convert less land to transportation use than the I-5 Alternative. The Kent/Des Moines SR 99 East Station Option would convert more commercial property but less acreage overall than the I-5 Alternative because the footprint for the station and parking is smaller. The Kent/Des Moines At-Grade Station Option would result in slightly less conversion of land than the I-5 Alternative and would mostly affect vacant property.

Landfill Median Alignment Option

The I-5 Landfill Median Alignment Option would convert more commercial property, but less land overall compared to the I-5 Alternative.

Federal Way City Center Station Options

The Federal Way City Center station options would convert more land to transportation use than the I-5 Alternative. The Federal Way I-5 Station Option would convert the greatest number of acres to a transportation use. The majority of the land converted by the Federal Way I-5 Station Option would be commercial. The Federal Way S 320th Park-and-Ride Station Option would convert less commercial property in the City Center than the I-5 Alternative, while the Federal Way I-5 Station Option would convert more.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would convert the least amount of land to transportation use because the north end is in the median of SR 99, and south of Kent-Des Moines Road the alternative is mostly within I-5 right of way. Much of the land that would be converted is commercial, with smaller amounts of institutional, vacant, single-family, and multi-family property (Table 4.2-3). Station or alignment

options described for the SR 99 and I-5 alternatives could be included in the associated portions of the SR 99 to I-5 Alternative.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative, without considering station options or alignment options, would convert the most amount of land to transportation use. Most of the land that would be converted to transportation use would be either commercial or institutional (Table 4.2-3). Station or alignment options described for the SR 99 and I-5 alternatives could be included in the associated portions of the I-5 to SR 99 Alternative and would have the same impacts.

Indirect Impacts

Transit-Oriented Development Potential

Improvements in transportation systems can influence changes to nearby land uses. The FWLE would directly affect land use through property acquisition required for the project. However, the project itself would not directly change the uses of the land surrounding the project. Property owners make decisions about developing or redeveloping their property, and cities and counties control land-use regulations, including zoning. However, a new light rail investment can be a catalyst for TOD and redevelopment near light rail stations when local jurisdictions have planned for a higher density of land use and/or a mixture of uses. The FWLE could indirectly affect land use in areas surrounding the future light rail stations.

Increased development around the stations could provide additional public benefits such as increased transit ridership, traffic congestion relief, improved air quality, infill development and job opportunities, natural resource preservation, more housing choices, less energy consumption, and better use of public infrastructure. Revitalized station areas could attract residents and employers who would ride the light rail as well as those who would not.

TOD Conditions

TOD generally takes place under three conditions:

- When stations are located in prime regional and community centers attractive to typical market forces.
- When regional and local real estate markets are active, including willing property owners and investors.
- When public policies and regulations permit or encourage intensive development in station areas.

The Sound Transit Board adopted a Transit Oriented Development (TOD) policy in 2012 (Resolution R2012-24). It defines TOD goals and provides guidance for Sound Transit to use in the evaluation, facilitation, and implementation of TOD as it builds the regional transit system. The purpose of the policy is to support land-use change and economic development that would improve quality of life, support achievement of comprehensive and regional plans, and maximize ridership. Sound Transit's TOD policy contains

goals to support and encourage economic development, TOD, non-motorized access, housing options, and sustainability.

The TOD policy directs Sound Transit to consider TOD potential in the development of its transit projects. This includes identifying agency and community TOD opportunities and strategies during early project planning. Opportunities for partnerships with public and private interests should also be considered in decisions about acquisition, use, and disposition of land.

Experience in the United States indicates that new transit facility investments can have a major influence on land use. Supportive policies, plans, land-use regulations, and incentives can be effective in facilitating TOD near transit stations.

The potential for TOD in the FWLE corridor has been assessed as indirect impacts because TOD would not be a project element. Sound Transit's TOD program would evaluate development opportunities at specific locations as part of the station area planning efforts once a preferred alternative is identified and during final design. Sound Transit has evaluated the relative degree to which the FWLE station locations could support TOD. The analysis is documented in the *FWLE TOD Potential Technical Memorandum* (Sound Transit, 2015).

Purpose of the TOD Analysis

The TOD analysis was designed to help Sound Transit answer the following key questions:

1. Within each of the station areas, which station locations would be more supportive of TOD?
2. What combination of alignment and station locations would be more supportive of TOD?
3. Would potential additional stations at S 216th Street and S 260th Street enhance support for TOD?

To assess which station locations would be most supportive of TOD, each station location was evaluated against four general categories:

- **Access to each station location** - How accessible is the station for pedestrians, bicycles, other forms of transit, and automobiles?
- **Land Use, Plans & Policies, and Utilities around each station location** - How do existing land use policies, plans, regulations, and infrastructure support new development?
- **Market support at each station location** - Is the location competitive for multi-family housing, retail, office, and/or lodging?
- **Land availability around each station location** - How much land has the potential to support new TOD?

The four categories were considered together to provide an overall assessment of the degree to which each station option would be supportive of TOD.

Each station area was rated using a combination of quantitative and qualitative assessments based on the information available at the time of the analysis. The assessment was designed to help identify the best station location within each of the five station areas in the corridor. Station locations that are more supportive of TOD would also be more likely to experience changes in land use and development patterns when the project is built. How supportive a station is of TOD is one component of many that will help to inform the Sound Transit Board in identifying a preferred alternative. TOD support will continue to be assessed as the project evolves.

Results of the TOD analysis are summarized on Exhibit 4.2-4, which compares station options in each station area, and are mapped on Exhibit 4.2-5. The analysis is described below by station area. The amount of land with TOD potential (as determined by the land availability measure) generally mirrors the overall findings on how supportive a station area is of TOD. The acres of land with TOD potential within ¼ mile of the station areas are summarized in Table 4.2-4. More detailed information on TOD potential is provided in Appendix D4.2.

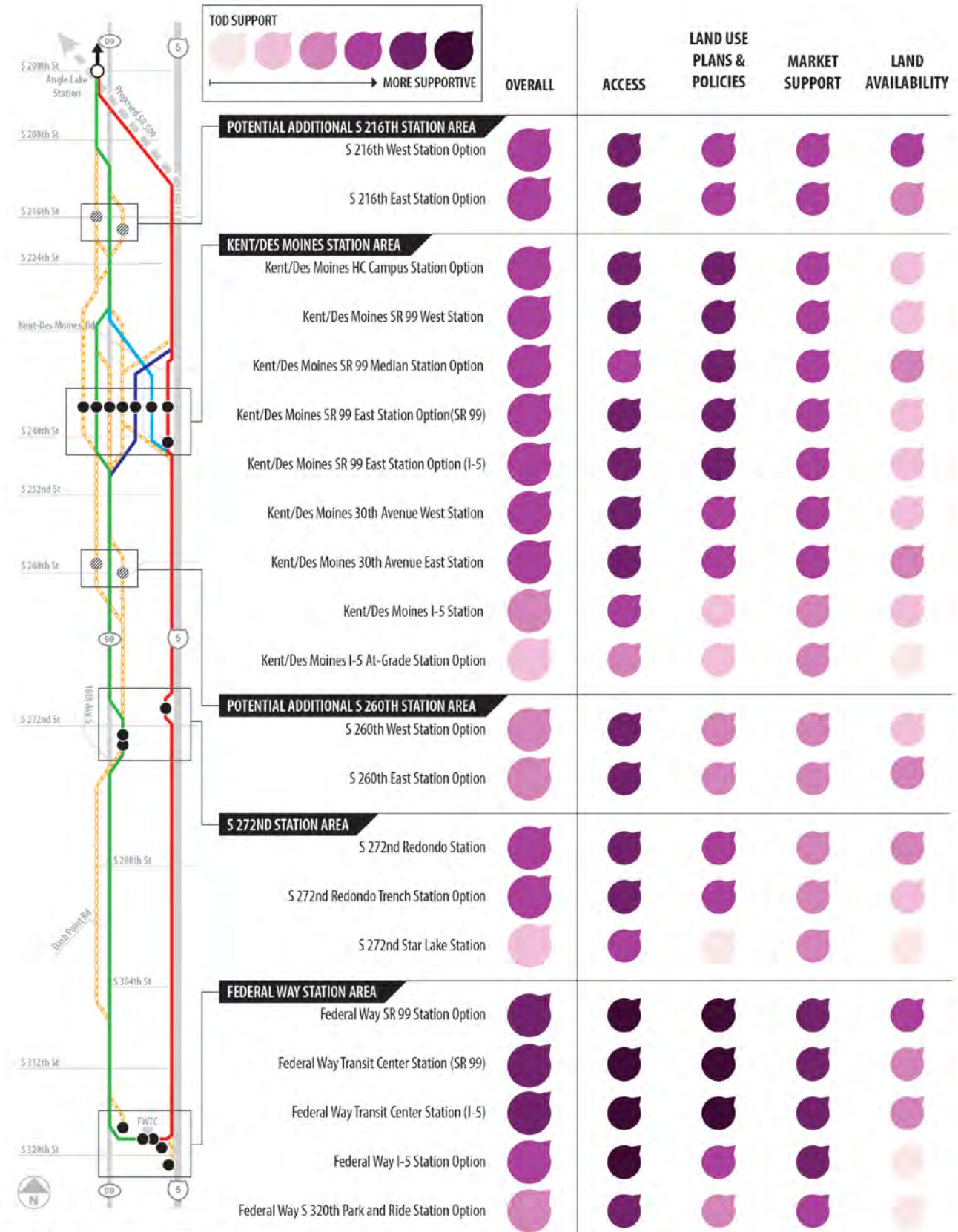
TABLE 4.2-4
TOD Potential

Station	Land with TOD Potential (acres) within ¼ Mile
S 216th Station Area	46-53
Kent/Des Moines Station Area	28-47
S 260th Station Area	36-43
S 272nd Station Area	5-44
Federal Way City Center Station Area	18-54

Note: TOD potential was evaluated by comparing the amount of redevelopable land within ¼ mile of the station to the total acreage of land overall in that ¼-mile area.

In general, alignments along SR 99 are more supportive of TOD than alignments along I-5, primarily due to three key differentiating factors: access (transit connections, access to the station area), land use (transit-supportive land use and zoning), and land with TOD potential (acres of land). Stations along I-5 had the lowest performance because of the following considerations:

- I-5 is a major barrier to station access.
- There is limited land with TOD potential.



Note: Stations listed west to east within each station area.

EXHIBIT 4.2-4
TOD Study Rating Summary

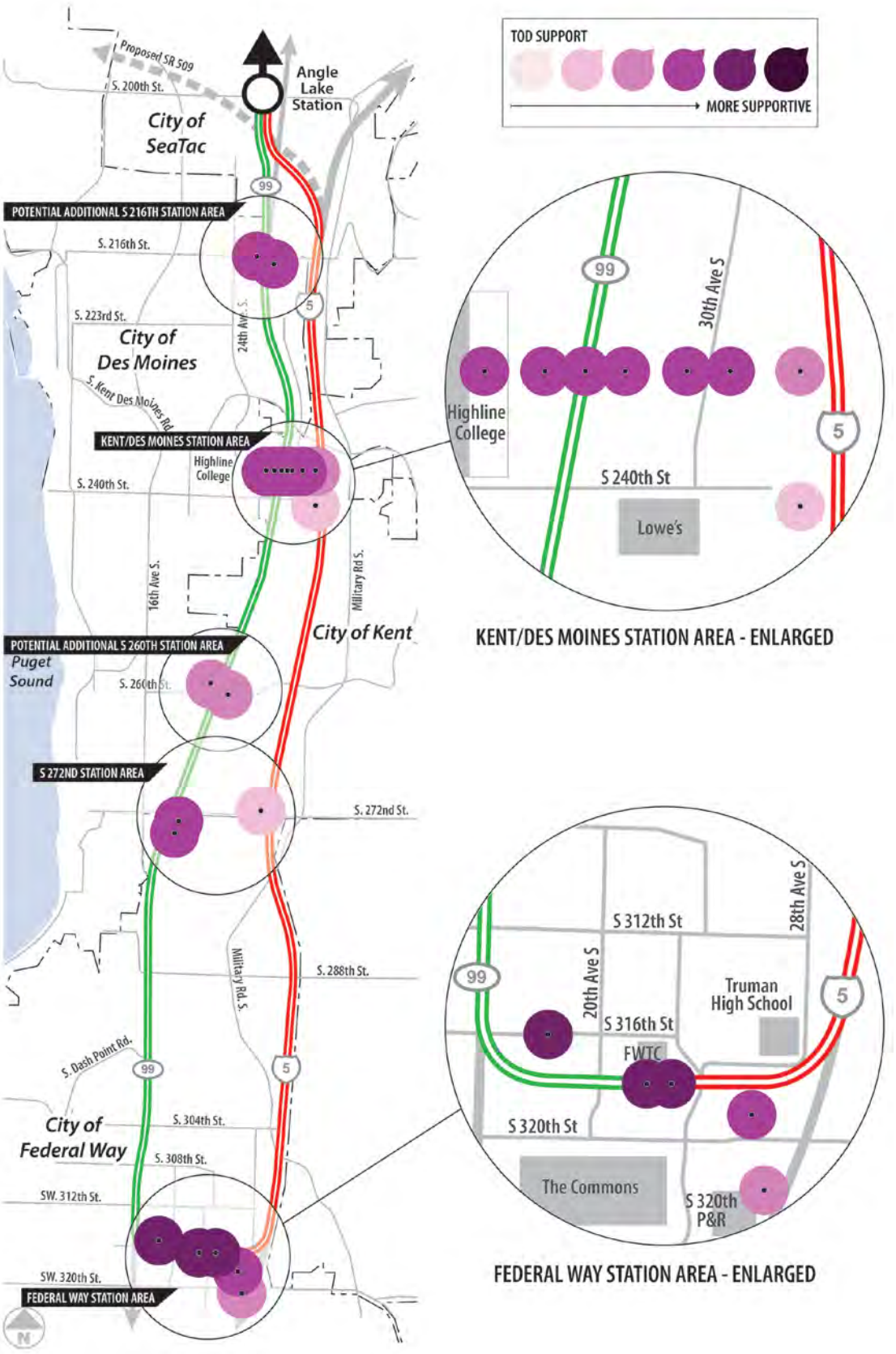


EXHIBIT 4.2-5
TOD Study Rating Map

- Any I-5 alignment must connect to the S 272nd Star Lake Station, which is the lowest performing station overall in terms of TOD support. This station lowers the TOD support score for the entire alignment, regardless of what station it connects to at Kent/Des Moines or Federal Way.
- There is no direct connection to RapidRide for stations along I-5 at Kent Des Moines or S 272nd Street.

Overall, the Federal Way Transit Center Station and Federal Way SR 99 Station Option would have the greatest potential for TOD, followed by the Kent/Des Moines SR 99 West Station, Kent/Des Moines SR 99 Median Station Option, and the Kent/Des Moines SR 99 East Station Option (for both the SR 99 Alternative and the I-5 Alternative).

S 216th Station Area (Potential Additional Station)

Within the S 216th station area, the two potential station options (West and East) are similar and would be relatively supportive of TOD. The S 216th East Station Option would have a very slight advantage in bus access and existing land use. The two options would be identical in terms of market support. The S 216th West Station Option would have slightly more land with TOD potential.

Kent/Des Moines Station Area

Within the Kent/Des Moines station area, the nine station locations have varying degrees of support for TOD. All of the SR 99 Alternative stations, the SR 99 East Station for the I-5 Alternative, and the 30th Avenue West and East stations are all moderately supportive of TOD. The other two I-5 station options (I-5 At-Grade and SR 99 East) would be the least supportive of TOD in this station area.

For the Kent/Des Moines station area, the options on SR 99 all received higher combined access ratings than those on I-5. The SR 99 East and West locations performed the best in terms of access, driven by station designs and locations that favor strong bus access in particular.

Land use, plans, and policies ratings for the nine options at Kent/Des Moines correlated with proximity to Highline College. The Highline College Campus option performed the best and the I-5 options the worst. Market support ratings indicated little

differentiation between station options, with the two I-5 options performing only slightly worse than the others.

The 30th Avenue East Station would have the greatest amount of land with TOD potential, followed by the SR 99 Median Station. The I-5 At-Grade Station would have the least amount of land with TOD potential.

S 260th Station Area (Potential Additional Station)

Within the S 260th station area, both potential additional station options (West and East) are relatively similar with respect to their support for TOD. The only notable difference is that the 260th East Station Option would have slightly more land with TOD potential. Ratings for access; land use, plans, and policies; and market support are basically the same for the two stations.

The overall degree to which these stations are supportive of TOD is relatively low compared to most of the other station areas along the corridor, in large part due to the relatively low ratings in the land use category.

S 272nd Station Area

Within the S 272nd station area, the S 272nd Redondo Station and the S 272nd Redondo Trench Station Option are similarly supportive of TOD. The only notable difference is that the S 272nd Redondo Station has more acres of land with TOD potential than the Redondo Trench Station Option.

The S 272nd Star Lake Station is less supportive of TOD than the two Redondo station options in all four categories. Although the S 272nd Star Lake Station is closer to I-5 and therefore has better auto access, the other three modal access criteria favor the Redondo options by a substantial margin. Star Lake also has much less transit-supportive land use and utilities. In terms of market support, the three options received similar overall scores, with the Redondo options indicated as very slightly better. The S 272nd Star Lake Station has less land with TOD potential compared to the Redondo station options. This is primarily because I-5 bisects the Star Lake station area and a large portion of the area is wetlands.

Federal Way City Center Station Area

The two Federal Way Transit Center stations (SR 99 and I-5) and the Federal Way SR 99 stations are similarly supportive of TOD. The close

proximity to the existing transit center provides excellent bus access for both Federal Way Transit Center stations.

Comparatively, the Federal Way I-5 Station Option, while it has the highest possible bus access rating, has much less transit-supportive land use. It has the lowest TOD potential of the five Federal Way options.

The Federal Way S 320th Park-and-Ride Station Option is the least supportive of TOD in the Federal Way station area, with the lowest individual ratings for access, land use, and market support categories. This station option also offers the second lowest amount of land with redevelopment potential.

Proximity Impacts

Proximity land-use impacts could occur if noise and visual impacts were severe enough to cause changes in adjacent land uses. Of the identified visual and noise impacts associated with the build alternatives, none would be so severe that they would negatively affect existing or potential future use of the land. Refer to Section 4.5, Visual and Aesthetics, and 4.7, Noise and Vibration, for information on these impacts.

4.2.5 Potential Mitigation Measures

No land use mitigation would be required during operation of the Federal Way Link Extension. In general, the FWLE would not result in inconsistencies with adopted land-use plans. Refer to Section 4.1 for information on how Sound Transit would minimize the impacts associated with required acquisitions, displacements, and relocations.

4.3 Economics

4.3.1 Summary

This section evaluates the potential effects on the local and regional economies from the Federal Way Link Extension (FWLE) alternatives. Economic impacts of the FWLE would include displacement of local businesses and employees due to land acquisition, and reduction of property tax revenue resulting from land being converted to transportation facilities. Table 4.3-1 provides information on potential business and employee displacements along with property tax impacts. The displacements and property tax impacts would be updated as the project design is refined.

TABLE 4.3-1
Range of Business and Employee Displacements and Property Tax Impacts by Alternative

Alternative	Business Displacements (Range)	Employee Displacements (Range)	Annual Property Tax Impacts (Range)
SR 99 Alternative	**104** (84-140)	**580** (480-980)	**$91,380** ($77,856-$133,014)
I-5 Alternative	**29** (4-46)	**260** (10-390)	**$53,575** ($29,907-$74,562)
SR 99 to I-5 Alternative	**43** (23-56)	**420** (210-480)	**$58,135** ($35,235-$74,125)
I-5 to SR 99 Alternative	**98** (85-119)	**500** (480-640)	**$95,229** ($92,734-$116,580)

A potential indirect beneficial economic effect of the FWLE is the possibility that the transit investment could encourage private investment in transit-oriented development (TOD), which could result in increased property tax and sales tax revenues for local jurisdictions. Alternatives in the State Route (SR) 99 corridor generally have greater potential and opportunities for the emergence of TOD because the zoning is more supportive of this development, there are fewer physical major impediments to pedestrian movement (such as limited crossings of I-5), and this corridor has a larger area of redevelopable land. Appendix D4.3 contains tables with supporting information for the assessment of tax impacts.

4.3.2 Introduction to Resource and Regulatory Requirements

Regional transit projects such as the FWLE can change patterns of regional and local mobility and access, which in turn can affect aspects of the regional or local economies such as development

patterns, employment opportunities, business accessibility, and/or retail sales. The FWLE may also have more localized economic impacts on businesses and properties in the cities it would pass through.

The purpose of the economic analysis is to identify the potential adverse and beneficial impacts of the FWLE on the local and regional economies. The analysis includes the anticipated direct and indirect impacts from business displacements and changes in tax revenue for the FWLE alternatives in the corridor when compared to the No Build Alternative. There are no regulatory requirements related to economics.

4.3.3 Affected Environment

Sound Transit evaluated economic impacts in a study area consisting of three different scales:

- **Regional:** Economic impacts on the regional economy (such as effects on employment, traffic mobility, and congestion) were analyzed for a study area consisting of the four counties in the Central Puget Sound Region: Snohomish, King, Kitsap, and Pierce.
- **City:** Economic impacts of the project on local tax revenues were assessed for cities that would be affected by property acquisitions (SeaTac, Des Moines, Kent, and Federal Way).
- **Site-specific:** Site-specific impacts were evaluated for a study area of a ½ mile around the light rail alignments and stations. As described in Section 4.3.3.2, the study area for the economic analysis is generally bounded by a ½-mile radius around the alignments and stations, but the transportation analysis zones (TAZs) used for data collection include some geographic areas more than a ½ mile from the project alignment in order to obtain complete data coverage of the study area.

4.3.3.1 Regional Demographic and Economic Trends

This section provides demographic and economic regional forecasts for the four-county Central Puget Sound Region.

Population, Households, and Employment

Regional economic and demographic forecasts are prepared periodically by the Puget Sound Regional Council (PSRC). Table 4.3-2 shows detailed population, household, and employment data from 2010, along with projections for 2035 for the four counties in the region and the total for the region. Although King County has lower

population and household growth rates than the other counties, its growth is projected to account for 40 percent of total regional population growth and 52 percent of household growth.

TABLE 4.3-2
Regional Population, Household, and Employment Forecasts, 2010-2035

County	2010	2035	Average Annual Growth Rate
Population			
King	1,931,249	2,394,179	0.9%
Kitsap	251,133	373,567	1.6%
Pierce	795,225	1,038,757	1.1%
Snohomish	713,335	941,987	1.1%
Total	3,690,942	4,748,490	1.2%
Households			
King	789,232	1,017,084	1.0%
Kitsap	97,220	147,376	1.7%
Pierce	299,918	402,387	1.2%
Snohomish	268,325	371,358	1.3%
Total	1,454,695	1,938,205	1.2%
Employment			
King	1,181,537	1,750,151	1.6%
Kitsap	97,417	131,063	1.2%
Pierce	317,874	465,692	1.5%
Snohomish	268,586	402,847	1.6%
Total	1,865,414	2,749,753	1.6%

Source: PSRC, 2013a.

The employment growth rate in King County is expected to average 1.6 percent per year, similar to the regional level. In keeping with regional and national employment trends, most of these new jobs are anticipated to be created in the service sector, specifically food and beverage services, professional and business services, and health care.

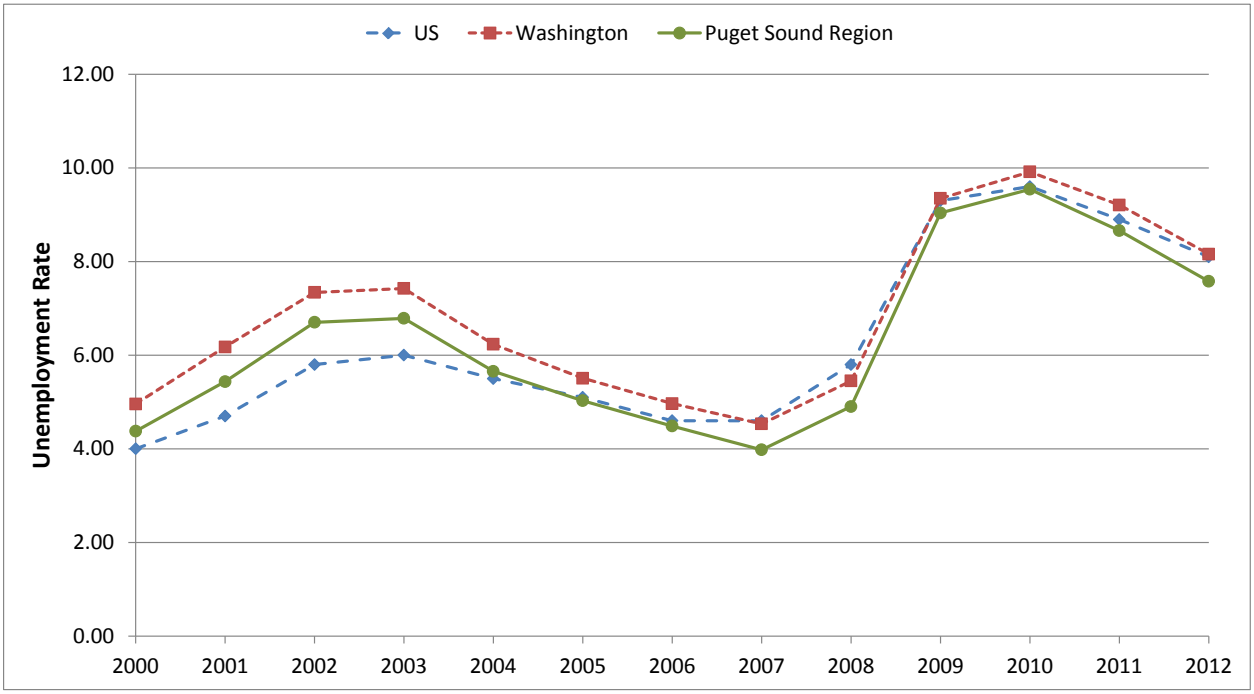
Income

Median household income in the Puget Sound Region is higher than the state average, although it has fluctuated in recent years due to the economic recession. According to the U.S. Census, median household incomes in the counties in the Central Puget Sound Region grew from 2005 to 2008, then generally declined over the next several years, beginning to stabilize in 2011 (U.S. Census Bureau, 2011). All four counties ended 2011 with median incomes below their

2008 peak. In 2011, King County had the highest median household income at $68,775, followed by Snohomish County at $63,685, Kitsap County at $60,314, and Pierce County at $55,214.

Unemployment

Exhibit 4.3-1 charts unemployment trends for the region, Washington State, and the United States over the period from 2000 to 2012. From 2000 until approximately 2005, the region's unemployment rate was lower than that of Washington State as a whole, but still higher than the national unemployment rate. From approximately 2006 through 2012, the region's unemployment rate has remained below those of both the state and the nation.



Note: Regional unemployment was calculated using an employee-weighted average of the unemployment rates for the Seattle-Tacoma-Bellevue, Washington, Metropolitan Statistical Area (which includes King, Snohomish, and Pierce Counties) and the Bremerton-Silverdale, Washington, metropolitan statistical area (which includes Kitsap County).

Source: U.S. Bureau of Labor Statistics, 2013.

EXHIBIT 4.3-1
Unemployment Rates, 2000–2012

4.3.3.2 Demographic and Economic Trends in the Study Area

Table 4.3-3 summarizes population, household, and employment forecasts for TAZs from PSRC that are within ½ mile of the alignment alternatives. The proximity of the alternatives results in many of the same TAZs falling within the study areas for all alternatives. Population, household, and employment figures for individual jurisdictions are based on TAZs that intersect with city boundaries.

TABLE 4.3-3
Study Area Population, Household, and Employment Forecasts, 2010–2035, by Jurisdiction

Jurisdiction	SR 99 Corridor			I-5 Corridor		
	2010[a]	2035[b]	Average Annual Growth Rate	2010[a]	2035[b]	Average Annual Growth Rate
SeaTac						
Population	9,223	14,273	1.8%	9,223	14,273	1.8%
Households	2,978	5,664	2.6%	2,978	5,664	2.6%
Employment[c]	3,727	12,612	5.0%	3,727	12,612	5.0%
Tukwila[d]						
Population	1,017	4,561	6.2%	1,017	4,561	6.2%
Households	471	2,040	6.0%	471	2,040	6.0%
Employment	5,005	8,253	2.0%	5,005	8,253	2.0%
Des Moines						
Population	21,969	26,234	0.7%	13,722	15,711	0.5%
Households	8,536	11,186	1.1%	5,003	6,301	0.9%
Employment	5,619	11,031	2.7%	3,237	6,284	2.7%
Kent						
Population	9,923	12,098	0.8%	18,174	21,182	0.6%
Households	3,535	4,703	1.2%	6,695	8,330	0.9%
Employment	1,645	2,896	2.3%	3,433	5,372	1.8%
Federal Way						
Population	31,128	36,853	0.7%	20,306	25,150	0.9%
Households	11,619	14,854	1.0%	7,796	10,434	1.2%
Employment	6,805	11,437	2.1%	6,196	9,849	1.9%
Unincorporated King County[e]						
Population	-	-	-	22,098	28,098	1.0%
Households	-	-	-	7,412	10,286	1.3%
Employment	-	-	-	5,439	11,315	3.0%
Total						
Population	**73,260**	**94,019**	**1.0%**	**84,540**	**108,975**	**1.0%**
Households	**27,139**	**38,447**	**1.4%**	**30,355**	**43,055**	**1.4%**
Employment	**22,801**	**46,229**	**2.9%**	**27,037**	**53,686**	**2.8%**

Source: PSRC, 2013b.
[a] 2010 numbers are based on TAZ-level estimates of actual population, households, and employment.
[b] 2035 numbers are based on TAZ-level forecasts derived from PSRC's Land Use Target forecast dataset.
[c] Jurisdiction includes TAZs for which employment data has been suppressed. Actual employment is likely to be slightly higher than indicated here.
[d] All areas of Tukwila within the study area are located east of I-5.
[e] All unincorporated TAZs are located east of I-5. The SR 99 Corridor does not contain any unincorporated areas.

For TAZs that cross into two or more jurisdictions, the jurisdiction with the largest geographic area within the TAZ was assigned to that individual TAZ. Also important to note is that the TAZs cover an area that extends outside the study area.

As a result, the projected population and employment figures in the table are likely higher than the actual population and employment within ½ mile of the alignments. In addition, TAZs located east of Interstate 5 (I-5) are large and include much of the Kent Valley, and therefore may include some population and employment that may be less likely to use and benefit from the FWLE. For the SR 99 Corridor, 7,349 jobs and 16,286 residents are located in TAZs east of I-5. By 2035, these areas are forecast to contain 11,602 jobs and 21,837 residents. For the I-5 Corridor, 12,788 jobs and 38,384 residents are located in TAZs east of I-5. By 2035, these areas are forecast to contain 22,917 jobs and 49,935 residents.

Major Employers in the Project Vicinity

Employment in the vicinity of the study area encompasses a variety of industries and business sectors, including transportation, education, and retail. Seattle-Tacoma International Airport, operated by the Port of Seattle, is located at the northern edge of the study area. Highline College (HC) is located in Des Moines on SR 99 at S 240th Street. The Commons at Federal Way, a major shopping and entertainment center, and surrounding retail activities are located at the southern end of the study area between SR 99 and I-5 around S 320th Street. The area east of I-5 and west of SR 167 contains several large industrial and business parks that are home to a variety of distribution and manufacturing employers, including Boeing's Kent Space Center, Sysco, Hexcel Corporation, and FedEx.

Study Area Population and Employment

As shown in Table 4.3-3, the I-5 corridor has a greater number of people, households, and jobs within a ½ mile than the SR 99 corridor.

4.3.3.3 Regional Transportation of Goods and Services

Both regional and interstate commerce are heavily dependent on the movement of goods and people in the I-5 and SR 99 corridors. Both corridors currently experience heavy congestion during peak hours. Congested conditions on these regional highways can create logistical challenges for local businesses, limiting their ability to efficiently deliver goods in the region and restricting their access to labor due to extended commute times. These conditions have led to a rise in the

number of transport companies arranging deliveries to customers during off-peak hours. This practice is often not feasible for many smaller businesses, which may find it more effective to relocate to less- congested areas of the region. Chapter 3, Transportation Environment and Consequences, contains a detailed discussion of current and future travel conditions in the I-5 and SR 99 corridors, including the general mobility of freight in the region.

4.3.4 Environmental Impacts

4.3.4.1 No Build Alternative

The No Build Alternative would have fewer transportation options and longer travel times for transit riders (Chapter 3, Transportation Environment and Consequences, provides additional information on delays). Fewer transportation options and longer travel times may potentially result in increased road congestion and less transit usage due to fewer alternatives to driving and slower buses from more congestion. This may deter residents and businesses, reducing the pace of development as well as the overall level of investment in the study area. In addition, the development that occurs could be more dispersed and of lower density than with the FWLE. The No Build Alternative would likely result in a different pattern of economic development and property redevelopment than with the FWLE.

4.3.4.2 Build Alternatives

The extension of the Link light rail system from SeaTac to Federal Way would have economic impacts on the local business environment, adjacent communities, and the region. Direct impacts may include business and employee displacements, and tax revenue impacts on local communities. Indirect impacts may include changes to development patterns such as the amount, location, and intensity of development. Indirect impacts on local economic conditions may include changes in parking, noise, visual conditions and/or access. Impacts resulting from construction activities associated with the FWLE, including job creation from project construction, are described in Chapter 5, Construction.

Direct Impacts

This section discusses the direct economic and fiscal long-term impacts of transit operations, business displacement, and property acquisitions in the study area. Direct impacts include commercial properties acquired, displacement of businesses and employees for

each alternative, and impacts on the local tax base due to property acquisitions and business displacements.

Commercial Properties Acquired

Each alternative would result in the acquisition of commercial properties for construction of the FWLE. Commercial properties not only generate tax revenue for local governments, they provide employment opportunities and serve as anchors for the local economy. Each alternative and its associated design options would result in a different distribution of commercial property acquisitions within the project study area. Table 4.3-4 shows the total number of commercial properties that would be fully acquired for each alternative and the number of parcels by city.

TABLE 4.3-4
Commercial Property Acquisitions by City

Alternative	Total Number of Commercial Parcels Impacted (Full Acquisitions)	Number of Commercial Parcels Impacted by City (Full Acquisitions)			
		SeaTac	Des Moines	Kent	Federal Way
SR 99 Alternative	**38** (31-65)	**0** (0-1)	**11** (2-21)	**16** (12-35)	**11** (11-15)
I-5 Alternative	**7** (0-25)	**0** (0-0)	**0** (0-1)	**5** (0-17)	**2** (0-7)
SR 99 to I-5 Alternative	**16** (14-25)	**0** (0-1)	**7** (7-11)	**7** (7-7)	**2** (0-7)
I-5 to SR 99 Alternative	**34** (34-53)	**0** (0-0)	**1** (1-3)	**22** (22-36)	**11** (11-15)

As shown in Table 4.3-4, the SR 99 Alternative would result in the highest number of commercial property acquisitions, distributed fairly evenly between the cities of Des Moines, Kent, and Federal Way. The City of SeaTac would experience relatively few commercial property acquisitions under any of the alternatives. Commercial property acquisitions have the potential to result in business and employee displacements, as well as impacts on local property tax revenue, as discussed in the following sections. The impacts associated with each option are shown in Table D4.3-1 in Appendix D4.3.

Displacements

Table 4.3-5 shows the estimates by alternative of commercial, industrial, public, or institutional properties that are projected to be partially or fully acquired, and businesses and estimated employees

TABLE 4.3-5
Properties Affected and Displacements by Alternative

Alternative		Total Commercial, Industrial, Public, and Institutional Parcels Affected		Displacements	
		Partial	Full	Businesses	Employees
SR 99 Alternative		**171**	**38**	**104**	**580**
S 216th Station Options	S 216th West Station	-2	+4	+13	+60
	S 216th East Station	-1	+3	+2	+10
Kent/Des Moines Station Options	Kent/Des Moines HC Campus Station	-4	-2	-7	+40
	Kent/Des Moines HC from S 216th W Station	-20	+7	+9	+200
	Kent/Des Moines SR 99 Median Station	+6	-8	+2	-10
	Kent/Des Moines SR 99 East Station	-5	-6	-1	-80
S 260th Station Options	S 260th West Station	-27	+13	+18	+140
	S 260th East Station	-11	+9	+21	+80
S 272nd Redondo Trench Station Option		-29	+6	--	+60
Federal Way SR 99 Station Option		-15	+4	-13	-20
I-5 Alternative		**34**	**36**	**29**	**260**
Kent/Des Moines Station Options	Kent/Des Moines At-Grade Station	+2	-8	-5	-40
	Kent/Des Moines SR 99 East Station	+1	+4	+17	+130
Landfill Median Alignment Option		--	--	--	--
Federal Way City Center Station Options	Federal Way I-5 Station	-4	+5	-5	--
	Federal Way S 320th Park-and-Ride Station	-3	-1	-20	-210
SR 99 to I-5 Alternative		**45**	**26**	**43**	**420**
S 216th Station Options	S 216th West Station	-2	+4	+13	+60
	S 216th East Station	-1	+3	+2	+10
Landfill Median Alignment Option		--	--	-	--
Federal Way City Center Station Options	Federal Way I-5 Station	-4	+5	-5	--
	Federal Way S 320th Park-and-Ride Station	-3	-1	-20	-210
I-5 to SR 99 Alternative		**161**	**51**	**98**	**500**
S 260th Station Options	S 260th West Station	-23	+6	+11	+50
	S 260th East Station	-11	+9	+21	+80
S 272nd Redondo Trench Station Option		-29	+6	--	+60
Federal Way SR 99 Station Option		-15	+4	-13	-20

displaced (Section 4.1, Acquisitions, Displacements, and Relocations, provides additional information on displacements). Regional employment density averages for various types of businesses (retail, office, industrial, etc.) and King County Assessor information

regarding type of land use and net square footage of the affected buildings were used to estimate the number of employees for displaced businesses. This analysis assumed that affected buildings are completely occupied (i.e., no empty storefronts or office suites), so it represents a conservative estimate of affected employment in the study area.

The number of businesses displaced varies between alternatives. The SR 99 Alternative would displace the most businesses (104), although the I-5 to SR 99 Alternative would displace almost as many (100). The I-5 Alternative would displace the fewest businesses of the alternatives (29). As shown in Table 4.3-1, the maximum number of employees displaced would be approximately 980 for the SR 99 Alternative when combined with the S 216th West Station Option, the Kent/Des Moines HC Campus Station Option, the S 260th West Station Option, and the S 272nd Redondo Trench Station Option. This represents less than 4 percent of the 2010 employment base for either the SR 99 corridor or the I-5 corridor. When accounting for projected employment growth to the year 2035, this drops to less than 3 percent of the employment base for either corridor.

The displacement of businesses and employees does not necessarily mean those businesses and jobs would be permanently lost. Sound Transit provides relocation assistance to displaced businesses, and businesses are helped to relocate; therefore, it is likely that many jobs and businesses would be relocated and not lost. Businesses may choose to relocate to sites within the same area, but some businesses may relocate to other areas or permanently close once their property is purchased; in these cases, jobs associated with the displaced businesses may be lost. Relocation opportunities for local businesses are discussed in Section 4.1.5, Relocation Opportunities. The Sound Transit Acquisition and Relocation Policy, which describes the process for helping people whose property or business is acquired for Sound Transit projects, is summarized in Section 4.1.6.

SR 99 Alternative

The SR 99 Alternative would displace the greatest number of businesses with a total of 104 businesses affected and an estimated 580 employees. The S 260th East Station Option would have the greatest potential to displace additional businesses (up to 21 additional businesses), while the Kent/Des Moines HC Campus Station Option from the 216th West Station Option would have the

greatest increase in the number of employees displaced (up to 200 more).

I-5 Alternative

The I-5 Alternative would result in the fewest businesses displaced with a total of 29 businesses and 260 employees affected. The Kent/Des Moines SR 99 East Station Option would increase the number of businesses displaced by over 50 percent, affecting 17 additional businesses and displacing an estimated 130 additional employees.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would result in greater business displacement impacts than the I-5 Alternative, but less than the SR 99 Alternative, displacing 43 businesses and an estimated 420 employees.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would displace 98 businesses, 6 fewer than the SR 99 Alternative, and approximately 80 fewer employees. This alternative would have greater impacts than the I-5 and SR 99 to I-5 alternatives.

Impacts of Displacements on Tax Base of Cities

With all build alternatives, Sound Transit would acquire private residential and commercial properties, removing those properties from the tax rolls. Properties fully acquired by Sound Transit would no longer generate property tax revenues for the cities in which they are located. Table 4.3-6 presents the initial impacts on property tax revenues by alternative, based on 2013 assessed property values and city tax levy rates. The values depicted represent only property tax impacts on the cities of SeaTac, Kent, Des Moines and Federal Way. The project would not acquire any properties in unincorporated King County and would therefore have no property tax impacts on the County. These impacts are referred to as “initial property tax impacts” because the immediate impact of acquisition would be a reduction in property tax revenue. However, the long-term effects of acquisition depend on other factors. Property tax would no longer be collected from parcels fully acquired by Sound Transit; as a result, tax rates charged to remaining taxpayers could increase slightly to recover these lost funds.

TABLE 4.3-6
Initial Property Tax Impact by City

Alternative	Total Annual Initial Property Tax Impact[a]	Initial Property Tax Impact by City and Percentage of Budgeted Property Tax Revenue							
		SeaTac		Des Moines		Kent		Federal Way	
		%	$	%	$	%	$	%	$
SR 99 Alternative	**$91,380** ($77,855-$133,014)	**0.0%** (0.0-0.0)	**$0.00** ($0.00-$1,791)	**0.4%** (0.1-1.3)	**$14,269** ($4,808-$37,945)	**0.2%** (0.2-0.3)	**$29,275** ($24,833-$48,894)	**0.5%** (0.5-0.5)	**$47,836** ($45,341-$49,838)
I-5 Alternative	**$53,575** ($29,907-$74,562)	**0.0 %** (0-0)	**$1,156** ($1,516-$1,516)	**0.4%** (0.4-0.5)	**$13,496** ($13,207-$15,886)	**0.1%** (0.1-0.2)	**$16,023** ($15,543-$27,390)	**0.2%** (0.0-0.3)	**$22,900** ($0-$30,130)
SR 99 to I-5 Alternative	**$58,135** ($35,235-$74,125)	**0.0 %** (0-0)	**$0.00** ($0.00-$1,791)	**0.4%** (0.4-0.6)	**$14,417** ($14,417-$22,947)	**0.1%** (0.1-0.1)	**$20,818** ($20,818-$21,038)	**0.2%** (0.0-0.3)	**$22,900** ($0-$30,130)
I-5 to SR 99 Alternative	**$95,228** ($92,734-$116,580)	**0.0%** (0.0-0.0)	**$1,156** ($1,156-$1,156)	**0.4%** (0.4-0.6)	**$15,462** ($15,462-$21,034)	**0.2%** (0.2-0.3)	**$30,775** ($30,775-$50,124)	**0.5%** (0.5-0.5)	**$47,836** ($45,341-$49,838)

[a] Impacts are based on 2013 municipal budgets and levy rates.

Tax revenue for local cities is derived from a variety of sources. While this Draft EIS examines the effects on property tax revenue in detail, initial property tax impacts do not include all possible impacts on tax revenue to local cities. Tax impacts, both initial and long-term, also depend on the type of property acquired. For example, commercial or industrial properties that are converted to transportation use could also result in loss of Business and Occupation (B&O) and sales tax revenue, whereas residential properties would only result in property tax revenue loss. Some of the businesses displaced by construction of the project would likely relocate elsewhere within their current jurisdiction; however, reduced local tax revenues could result if businesses relocate outside of their current jurisdiction. Some of the land acquired may only be needed during construction and could be released after project completion, allowing for development and generation of new tax revenues. In addition, the presence of enhanced transit service could promote future private development and investment in the transit station areas, leading to long-term gains in property and sales tax revenue for cities. This is discussed in greater detail in the Positive Indirect Impacts and Potential for Transit-Oriented Development sections below.

Table 4.3-6 shows the initial property tax effects in dollars, as well as the percent of annual city tax revenue that would be removed due to full property acquisitions. The table shows the impacts of each of the four alternatives and provides a range for impacts when their associated station and alignment options are included. The range may include one or more options in order to determine the minimum and maximum potential impacts. On the whole, the impacts on municipal budgets resulting from removal of acquired properties from the tax rolls would be small.

For almost all alternatives and options, the initial property tax impact would represent less than 0.5 percent of the city's budgeted property tax revenue. The greatest impact would be property taxes impacts of 1.3 percent of the budget for the City of Des Moines, which would occur with the SR 99 Alternative combined with the potential additional station at S 216th Street (West option), the Kent/Des Moines HC Campus Station Option, and the potential additional station at S 260th Street (West option). The impacts associated with each option are shown in Table D4.3-2 in Appendix D4.3.

The SR 99 Alternative and the I-5 to SR 99 Alternative have the highest total initial property tax impacts at $91,380 and $95,229, respectively. The I-5 Alternative and the SR 99 to I-5 Alternative have lower initial property tax impacts at $53,575 and $58,135, respectively. The addition of various station options can either increase or reduce property tax impacts as a result of either requiring additional properties beyond the alternative, avoiding properties, or using property already publicly owned. In addition, the Landfill Median Alignment Option would result in a negligible increase in property tax impacts for the I-5 Alternative and SR 99 to I-5 Alternative.

Impacts on Regional Transportation of Goods and Services

The primary effects from operation of the project on regional transportation of goods and services would be changes in regional freight mobility on I-5 and SR 99, as well as the surrounding surface street network. As described in Chapter 3, Transportation Environment and Consequences, 2035 peak travel times in the I-5 and SR 99 corridors are anticipated to moderately increase relative to current conditions. The availability of light rail would allow travelers to avoid traffic congestion by using transit.

Future regional freight conditions would be similar relative to the No Build Alternative. Localized improvements in freight access could occur, but due to separation of the light rail line from most roadway travel lanes, the FWLE is not expected to adversely affect freight mobility. Chapter 3 contains a detailed discussion of transportation impacts associated with the FWLE.

Indirect Impacts

Operation of the FWLE could have both positive and negative indirect impacts on economic conditions in the study area. Light rail facilities provide additional transit access, which can increase property values near stations and increase the potential for development and redevelopment in station areas, but it can also change existing traffic patterns and vehicular access for businesses patrons. The following sections describe the positive and negative indirect impacts most likely to result from operation of the build alternatives.

Positive Indirect Impacts

Light rail projects often increase pedestrian activity in the vicinity of stations and can bring a large number of customers to businesses located near light rail stations. Increased access to transit can make

surrounding properties more desirable for commercial or mixed-use development through increased visibility and exposure to large volumes of pedestrian traffic. Likewise, convenient access to both transit and commercial businesses can foster residential or mixed-use development in the vicinity of stations. Retail and residential uses around light rail stations attract employment uses, particularly office and service uses, which are typically higher-density land uses. High-density, mixed-use land use patterns, and the potential for this type of development pattern to emerge under each of the alternatives, is discussed later in this section under Potential for Transit-Oriented Development. TOD potential is also discussed in Section 4.2, Land Use.

Recent studies in Denver, Buffalo, Washington D.C., San Francisco, and Portland indicate that both residential and commercial properties located near light rail transit stations are typically valued higher than similar properties without access to transit service (Jackson, 2010; Hess and Almeida, 2007; Cervero et al., 2004). The FWLE could also potentially lead to increased property values near light rail station areas, which would result in an associated increase in property tax revenue for cities. In addition, if the higher-density mixed-use land use patterns associated with TOD emerge, the greater density of businesses, employees, and residences could also lead to increased revenue for cities in the form of sales and B&O taxes.

While increased property values near FWLE light rail stations could be expected, they are not assured. Property values at any given location are influenced by a multitude of factors, and other forces such as consumer confidence, local development pressures, and fluctuations in the regional economy may either increase or constrict property values, regardless of the presence of light rail transit service. In addition to market factors, the emergence of the land use patterns associated with TOD and its associated property value and tax revenue benefits may also be aided or impeded by local development patterns and regulatory conditions. The potential for each of the alternatives to result in TOD is assessed later in this section under Potential for Transit-Oriented Development.

Negative Indirect Impacts

While the presence of light-rail facilities often has positive economic effects on the surrounding area, it is also possible for development of light rail to have negative effects on the local economic conditions.

The acquisition of commercially zoned property for light rail facilities would remove that property from a city's developable land base, reducing that city's overall commercial development capacity until additional property is zoned for commercial uses or zoning regulations are amended to allow for more intense development. This could occur along SR 99 where areas zoned as residential could be rezoned as commercial or mixed use, or commercial areas could be rezoned as mixed use. Construction of the FWLE would require the acquisition of commercially zoned properties in SeaTac, Des Moines, Kent, and Federal Way, which could result in reduced potential for long-term commercial growth, depending on how much of a city's commercial land base is acquired and whether a city modifies zoning elsewhere to allow for increased density that would generate greater tax revenue. Table 4.3-7 summarizes the percentage of each city's commercially zoned land base that would be fully acquired for construction of the FWLE under each of the alternatives. Percentages are presented as a range to account for variation due to inclusion of station and alignment options.

As shown in Table 4.3-7, the percentage of each city's commercially zoned land base that would be impacted by construction of the FWLE would vary fairly widely by alternative, but in most cases would impact only a small portion of the city's commercially zoned land. The greatest impacts would occur under the SR 99 and I-5 to SR 99 alternatives, which have the potential to affect up to 7.6 percent of the commercially zoned land in Federal Way, if Commercial and Mixed Use zoning categories are considered together.

TABLE 4.3-7
Percent of Total Commercially Zoned Land Within Each City to be Acquired for FWLE

Alternative	SeaTac		Des Moines		Kent		Federal Way	
	Commercial %	Mixed Use %	Commercial %	Mixed Use %	Commercial %	Mixed Use %	Commercial %	Mixed Use %
SR 99 Alternative	**0** (0-0)	**0** (0-0)	**2.2** (0.6-7.7)	**0** (0-0)	**1.2** (1.0-3.2)	**0** (0-0.2)	**2.4** (2.3-2.4)	**3.9** (3.9-5.2)
I-5 Alternative	**0** (0-0)	**0.1** (0.1-0.1)	**0** (0-0)	**0** (0-0)	**0.4** (0.4-1.2)	**0.1** (0.1-1.2)	**0** (0-0)	**2.5** (2.5-4.2)
SR 99 to I-5 Alternative	**0** (0-0)	**0** (0-0)	**1.5** (1.5-2.9)	**0** (0-0)	**0.6** (0.6-0.6)	**0.2** (0.2-0.2)	**0** (0-0)	**2.5** (2.5-4.2)
I-5 to SR 99 Alternative	**0** (0-0)	**0.1** (0.1-0.1)	**0** (0-1.0)	**0** (0-0)	**1.2** (1.2-3.2)	**0.3** (0.3-0.3)	**2.4** (2.3-2.4)	**3.9** (3.9-5.2)

Note: Range indicates range of impacts with options.
Sources: King County Assessor, City of SeaTac, City of Federal Way, City of Des Moines, City of Kent.

The impacts associated with each option are shown in Table D4.3-3 in Appendix D4.3.

The presence of light-rail facilities can also have effects on property values. Increased property values often result from the synergy created by the development of residential, retail, and transit in proximity. However, property values can be negatively affected if one or more of the components of this land use mix does not materialize. For example, if transit stations are located in areas where local land use and zoning regulations are not conducive to mixed use, retail, or high-density residential development, such as would be the case with existing single-family neighborhoods, light rail stations may be viewed negatively, rather than a benefit. As described in Section 4.5, Visual and Aesthetic Resources, the primary cause of negative visual impacts would be from alteration of vegetation and buildings, as well as the introduction of elevated structures. Likewise, the rail lines between stations have the potential to expose nearby properties to additional noise, light and glare, vibrations, and view impacts, while providing no amenities to increase property values. Anticipated noise and vibration impacts associated with construction of the FWLE are described in Section 4.7, Noise and Vibration, and all would be mitigated.

As described in Section 3.4.4, Parking, in Chapter 3, Transportation, all of the FWLE build alternatives would affect the amount of parking available in the project vicinity. While some new parking would be provided as part of the various station options, all of the alternatives would result in a net reduction in the amount of private, off-street parking in the area. Although lack of parking can deter patrons from frequenting local businesses, this effect may be offset by the increased availability of transit, depending on the type of business. Businesses that provide services or sell easily portable goods would be less affected by reductions in available parking than businesses that sell larger goods that require an automobile to move.

Potential for Transit-Oriented Development

Changes to transportation systems can influence nearby land uses. In the case of high-capacity transit projects like the FWLE, improved access to transit, combined with land use regulations that are conducive to a mix of residential and commercial uses and an active real estate market, can encourage increased development density near transit stations. The emergence of TOD in station areas can

provide economic benefits in the form of localized increases in property values and increased sales tax revenue.

Based on the factors described above, some station areas are more conducive to this pattern of development than others. As described in Section 4.2, Land Use, the greatest potential for TOD occurs in the Federal Way Station Area and, to a lesser extent, the Kent/Des Moines Station Area. In particular, the Federal Way Transit Center Station, Federal Way SR 99 Station, and the Kent/Des Moines SR 99 East Station options have the most supportive mix of conditions for TOD, and these areas would realize the greatest economic benefits associated with such development.

4.3.5 Potential Mitigation Measures

Long-term operation of the FWLE is not anticipated to result in adverse effects requiring the application of potential mitigation measures. Relocation assistance for business displacements is discussed in Section 4.1, Acquisitions, Displacements, and Relocations.

4.4 Social Impacts, Community Facilities, and Neighborhoods

4.4.1 Summary

All Federal Way Link Extension (FWLE) alternatives would travel along major transportation corridors and along the edges of neighborhoods, thus minimizing potential impacts. None of the FWLE alternatives would bisect a residential neighborhood, adversely affect community cohesion, or change access to or from neighborhoods, but the alternatives would affect neighborhoods by removing residences along the edges. The SR 99 Alternative would displace community facilities and have the greatest noise impacts before mitigation and displace the most businesses, but would have the fewest residential displacements. The I-5 Alternative would displace fewer community facilities and have the most residential displacements but fewer noise impacts before mitigation and displace the fewest number of businesses. The FTA has made a preliminary determination that the FWLE would not result in disproportionately high and adverse effects on minority and/or low-income populations. See Chapter 7, Environmental Justice, for additional information.

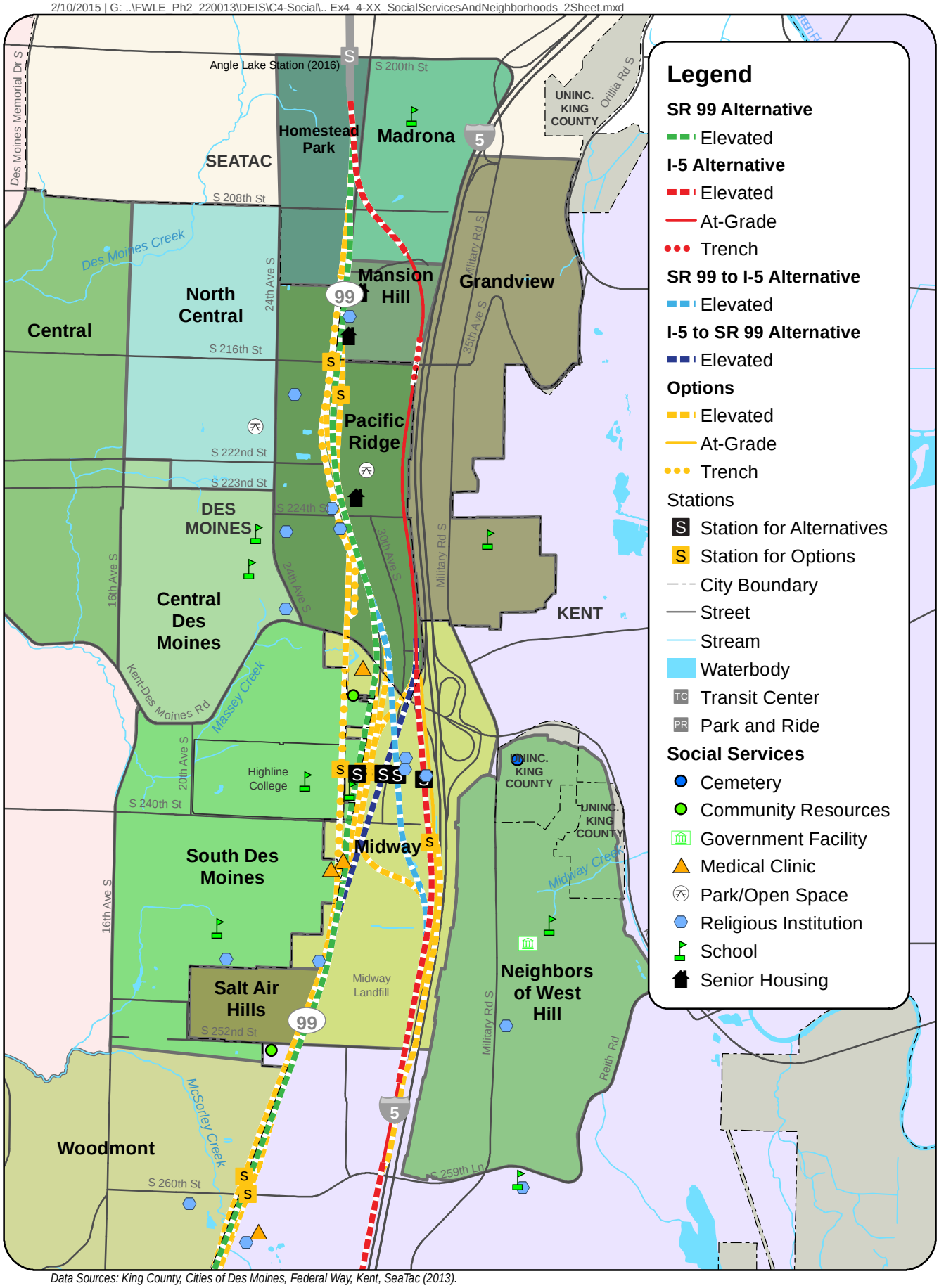
4.4.2 Introduction to Resources and Regulatory Requirements

This section evaluates how the FWLE could affect communities and neighborhoods in the study area. Consistent with guidance from the Federal Transit Administration (FTA), four key neighborhood and community issues are addressed: changes in neighborhood quality, barriers to social interaction, impacts on community resources, and impacts on safety and security.

Much of the analysis for this section reflects findings described in other sections and chapters, including Chapter 3, Transportation; Section 4.1, Acquisitions, Displacements, and Relocations; Section 4.2, Land Use; Section 4.3, Economics; Section 4.6, Air Quality and Greenhouse Gases; Section 4.7, Noise and Vibration; Section 4.14, Public Services; Section 4.17, Parkland and Open Space; and Chapter 7, Environmental Justice.

4.4.3 Affected Environment

The study area for social impacts, community facilities, and neighborhoods includes a ½-mile area around each FWLE alternative (Exhibits 4.4-1 and 4.4-2).



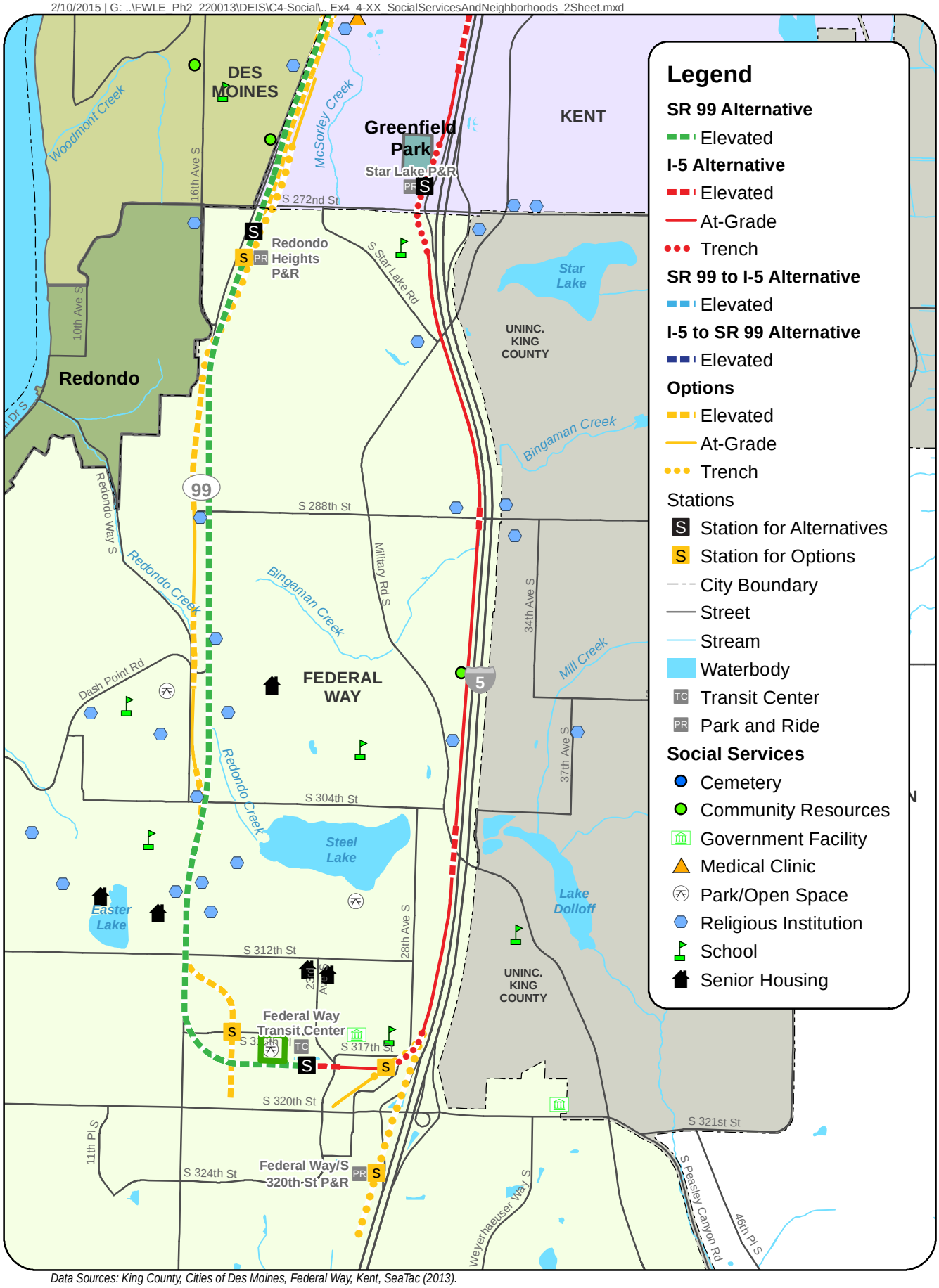
Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.4-1
Social Services and Neighborhoods (North)

Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.4-2
Social Services and Neighborhoods (South)

Federal Way Link Extension

Because of the proximity of the alternatives, there is some overlap in the ½-mile areas. The overall study area includes neighborhoods within SeaTac, Des Moines, Kent, Federal Way, and unincorporated King County. This section provides information on demographics and neighborhood characteristics, including location, development pattern, community resources, and accessibility. Exhibits 4.4-1 and 4.4-2 identify designated neighborhood boundaries located within the study area and the locations of community facilities, including parks, schools, religious institutions, social services, and public service facilities. Refer to Section 4.14, Public Services, Safety, and Security, for descriptions of public services including public and private schools, fire stations, police stations, and hospitals, and to Section 4.17, Parks and Recreational Resources, for information about and locations of parks within the study area.

4.4.3.1 Population Characteristics

Table 4.4-1 provides information on the demographics of the study area compared to the four cities in the study area and King County. The population within the study area is both ethnically and linguistically diverse, with larger concentrations of Korean, African (mostly Somali), and Hispanic populations than King County as a whole.

TABLE 4.4-1
Population Characteristics

	SR 99 Corridor	I-5 Corridor	SeaTac	Des Moines	Kent	Federal Way	King County
Total Population	52,034	58,108	26,909	29,673	92,411	89,306	1,931,2446
Population under 18 (%)	25.4	25.6	23.1	22.2	26.2	25.6	21.4
Population over 65 (%)	9.7	8.8	9.7	14.8	8.8	10.3	10.9
Minority (%)	55.6	56.1	60.5	43	50.3	48.4	27.1
Low-Income (%)	19.4	17.8	14.3	13.1	16.6	13.2	6.6
Median Household Income	$52,071	$57,295	$45,970	$59,577	$54,591	$54,856	$70,567
Households with No Vehicle (%)	10.5	7.4	8.2	6.6	7.6	8.1	9.1
Households with Limited English Proficiency (%)	9.6	11.0	11.0	5.9	9.7	7.6	5.1

Source: U.S. Census Bureau, 2010 and ACS, 2012.

Many residents in the SR 99 corridor are transit-dependent, and many in both the SR 99 and I-5 corridors are low-income, based on 2010 U.S. Census data. Chapter 7, Environmental Justice, provides more information on the minority and low-income populations, including Sound Transit's outreach efforts to these populations.

4.4.3.2 Study Area Characteristics

Both SR 99 and I-5 are major roadways that link the study area communities with the larger Puget Sound Region, but they also can be barriers to interaction within these communities because of their scale.

Community cohesion may be low in the study area because of the barriers to interaction, the lack of linkages between the smaller single-family subdivisions, and the frequent turnover that may occur in the larger apartment complexes. Many community resources for residents in the study area are located outside of the study area boundaries. Places for interaction include schools, libraries, community centers, religious facilities, and local retail shops. There are only a few parks within the study area where residents can interact.

SR 99 Corridor

SR 99 was the first roadway linking the region's primary economic centers of Seattle and Tacoma. Residential neighborhoods tend to consist of older established single-family housing primarily developed from the 1950s to the 1970s as suburbs for those who worked in Seattle or Tacoma. Other residential development in the study area includes a mixture of mobile home parks and both large- and small-scale multi-family complexes. With the construction of I-5 in the 1960s, regional traffic shifted to I-5, but SR 99 has remained a major arterial for the cities in the study area. In the last decade SR 99 has received high-occupancy vehicle/transit lanes, sidewalks, lighting, and landscaping, which has improved connections and accessibility along and across the roadway. Other roadways in the area have fewer sidewalks and are less pedestrian-friendly. The study area has few bicycle lanes and non-motorized trails. Many of the roadways within residential developments are cul-de-sacs, limiting connectivity. Although this development pattern limits interaction between neighborhoods or subdivisions, it also provides opportunities for interaction within specific residential developments. Mobile home parks and apartment complexes both experience limited interaction due to limited physical connectivity with other neighborhoods. Commercial development along SR 99 is a buffer from noise and traffic for residents farther east or west of the roadway, but also limits interaction between neighborhoods east and west. Some businesses that provide goods and services (e.g., grocery stores, clothing stores, automotive services, and hair salons) may provide

opportunities to interact for those residing in the study area. Some religious facilities are also located in the retail complexes.

I-5 Corridor

There are limited crossings of I-5 in the study area, which creates a barrier to interaction between the neighborhoods west and east of I-5. The I-5 study area is primarily residential, including single-family residences, multi-family housing, and mobile home parks that are adjacent to I-5. East of I-5 is primarily single-family residential developments and includes areas within unincorporated King County. Although I-5 is a barrier to interaction between areas west and east of the freeway, some local roadways provide access between neighborhoods. Similar to the SR 99 corridor, many of these roadways lack sidewalks and bike lanes. Community cohesion is more likely within the smaller developments rather than the larger neighborhoods.

4.4.3.3 Neighborhoods by Local Jurisdiction

Most neighborhood boundaries overlap the SR 99 and I-5 study areas. Federal Way does not have City-designated neighborhoods, so its residential areas are described in general.

City of SeaTac

The FWLE study area in SeaTac includes the Madrona, Homestead Park, and Mansion Hill neighborhoods west of I-5, and the Grandview neighborhood east of I-5 (Exhibit 4.4-1). The Homestead Park neighborhood consists mostly of commercial development and a large vacant area that formerly contained a number of smaller mobile home parks that were relocated by the Port of Seattle as mitigation for noise from Sea-Tac International Airport. Although some residential areas remain, the neighborhood lacks opportunities for interaction. Madrona includes single-family residences and apartment complexes as well as Madrona Elementary School, which provides opportunities for interaction. Mansion Hill consists primarily of single-family homes and includes some vacant property along the neighborhood edge that has been acquired by Washington State Department of Transportation (WSDOT) for the proposed SR 509 extension. As an older, established neighborhood, there is likely some cohesion within this neighborhood. The Grandview neighborhood consists mostly of single-family residences and includes a school and dog park that provide opportunities for interaction.

City of Des Moines

Des Moines has six neighborhoods within the study area (from north to south): North Central, Pacific Ridge, Central Des Moines, South Des Moines, Woodmont, and Redondo (Exhibit 4.4-1). The North Central neighborhood within the study area consists primarily of vacant land that was acquired by the Port of Seattle as mitigation for noise impacts associated with Seattle-Tacoma International Airport, and which is planned for redevelopment as the Des Moines Creek Business Park. There are a few residences, a large park, a post office, and religious facilities in this neighborhood.

The Pacific Ridge neighborhood is bisected by SR 99, with the majority of residential development located between SR 99 and I-5. Residential development includes a mixture of single-family houses, mobile home parks, and multi-family complexes. Many of the housing units are in multi-family complexes, which may reduce overall community cohesion in the neighborhood. Opportunities for interaction include Midway Park and religious facilities located along SR 99.

The Central Des Moines neighborhood within the study area includes mostly single-family residential developments and Midway Elementary School, Pacific Middle School, and Mt. Rainier High School. Opportunities for interaction within the neighborhood include the schools, a public swimming pool located at the high school, and religious institutions.

The South Des Moines neighborhood includes primarily single-family and multi-family residential developments, along with Highline College (HC) and some commercial development adjacent to SR 99. Highline College is one of the larger community colleges in Washington and includes branches of Central Washington University and Heritage University, and a preschool/Head Start early learning center. It offers a number of resources for the general public and provides opportunities for interaction. Other opportunities for interaction are located at Parkside Elementary School and Parkside Park.

The Woodmont and Redondo neighborhoods are primarily single-family residential neighborhoods, with community facilities including Woodmont Elementary School, Woodmont Library, and religious institutions. Cohesion is likely highest within single-family residential developments, although the community facilities within these

neighborhoods also provide opportunities for interaction. The Redondo neighborhood is located solely within the study area for SR 99.

City of Kent

Kent neighborhoods within the study area include Midway, West Hill, Saltair Hills, and Greenfield Park (Exhibits 4.4-1 and -2). The Midway neighborhood is not a City-recognized neighborhood, but the adopted *Midway Subarea Plan* (City of Kent, 2011) is intended to support development of a mixed-use neighborhood primarily between SR 99 on the west, I-5 on the east, Kent-Des Moines Road on the north and S 240th Street on the south. This area includes commercial uses and one community resource, a post office. Residential development is primarily mobile home parks and small apartment complexes. Opportunities for interaction among residents in the Midway neighborhood are low because of the few and disconnected residential areas, lack of community resources, and the commercial nature of the neighborhood.

The West Hill neighborhood is located east of I-5 and between Kent-Des Moines Road and S 259th Place and is predominantly single-family residential. Community facilities within the study area include Sunnycrest Elementary School, religious institutions, and a small neighborhood park, which provide opportunities for interaction.

The Saltair Hills neighborhood is primarily a single-family residential neighborhood located west of SR 99. Although there are no community facilities, the neighborhood has a central message board/kiosk, which contributes to cohesion. A retail complex along SR 99 includes a number of Hispanic businesses that provide interaction opportunities for this population.

The Greenfield Park Neighborhood is a small single-family development located north of the Star Lake Park-and-Ride. This neighborhood is isolated and has no community facilities, but its neighborhood council likely provides some cohesion and opportunities for interaction. Other residences adjacent to the Greenfield Park are not associated with the neighborhood.

City of Federal Way

The City of Federal Way does not have any designated neighborhoods; however, the residential areas within the study area include single-family and multi-family developments that likely have cohesion within each residential development. A number of

community facilities within this study area, including religious institutions, schools, neighborhood parks, and the larger Steel Lake Park, provide an opportunity for residents from the surrounding neighborhood to interact and create a sense of community cohesion.

4.4.4 Environmental Impacts

This section describes the potential beneficial and adverse impacts on social and community facilities within the study area, consistent with FHWA's publication *Community Impact Assessment: A Quick Reference for Transportation* (FHWA, 1996). The analysis includes the effects on community cohesion, neighborhood quality, barriers to social interaction, community facilities, and safety based on factors including property acquisitions and land use changes, visual or physical intrusion, changes in transportation and parking, and noise and vibration. This section also summarizes the project's indirect impacts.

4.4.4.1 No Build Alternative

The No Build Alternative would have no property impacts associated with light rail operation. Neighborhoods and communities would be likely to develop according to adopted plans, dependent upon economic conditions within the corridor. Residents of the neighborhoods and those who travel in or through the study area would not receive a more reliable mode of transportation and increased transit accessibility. Additional congestion associated with the No Build Alternative could affect the cohesiveness and could have adverse air quality and noise impacts on some neighborhoods and communities within the study area.

4.4.4.2 Build Alternatives

Direct Impacts

Impacts Common to All Alternatives

The FWLE could positively affect neighborhood quality by improving transportation access, reliability, and linkages to the surrounding region. Neighborhoods (particularly those near the light rail stations) may experience increased vitality in terms of improved access, residential infill, employment growth, and greater patronage of local businesses. The development of stations could enhance community cohesion by creating new meeting points for the surrounding neighborhoods. Pedestrian and bicycle mobility would be maintained as the alternatives are grade-separated and do not bisect any non-motorized connections, and the project would improve non-motorized access to regional transit. Refer to Chapter 3,

Transportation, for more information. FWLE improvements would meet the Americans with Disabilities Act requirements to ensure those with disabilities have access to the station areas.

The FWLE would acquire property, introduce a new source of noise, and change the visual character along the edges of neighborhoods. The overall character of the neighborhoods is not likely to change because Sound Transit would mitigate these impacts. The FWLE would not create new barriers to interaction because the alternatives are generally adjacent to SR 99 or I-5, which already act as neighborhood boundaries. Acquisitions that remove some but not all multi-family units or displace all residents within individual mobile home parks would affect cohesion within those developments. There would be changes to residences directly adjacent to the FWLE as a result of removed residential units and mature vegetation. Noise mitigation such as freestanding sound walls would also affect the visual character along the edge of adjacent neighborhoods.

Portions of properties acquired in the station areas that are not permanently needed for FWLE facilities could be redeveloped consistent with local zoning. While the displacements would be disruptive, none of the displacements would bisect or segment neighborhoods or change their overall character..

For all residential acquisitions, Sound Transit would try to help residents relocate in the same area in order to minimize impacts on their quality of life. This includes identifying replacement housing that considers such factors as proximity to commercial and community facilities, schools (if applicable), places of employment, and accessibility to transit if residents are transit-dependent.

The FWLE could displace some businesses that provide services to area residents (such as an ethnic grocery store) that are unique to the region, but due to the large minority populations in the study area similar businesses in the area are common and easily accessible to area residents. There are suitable opportunities for both business and residential relocation in the study area, but friends and neighbors in individual developments or neighborhoods could be affected by increased distance.

All of the FWLE alternatives would require the acquisition of one or more mobile home parks in the Midway neighborhood, which contains four mobile home parks. Mobile home parks that would be

acquired are owned by individuals or businesses, and park residents either rent their unit or own their unit and rent the lot. The mobile home parks in the Midway neighborhood range from 18 to 34 units and lack community facilities (e.g., outdoor spaces and playgrounds), which may limit interaction within the mobile home parks. They are located in areas without nearby community facilities and with nonresidential adjacent land uses related to automotive, warehouses/distribution, and offices, which limit opportunities to interact with others in the larger neighborhood. These factors may affect the sense of community in the Midway neighborhood compared to other neighborhoods in the study area that are entirely or predominantly residential, and thus lessen the impact of these displacements on the cohesiveness of the overall Midway neighborhood. Parts of other mobile home parks could also be acquired by some station options, as described below under the station option impacts.

The FWLE would operate on an exclusive guideway, and local access would be maintained under or over the guideway. There could be access changes or restrictions to adjacent properties as a result of the station configurations. The expansion of existing parking or construction of new parking lots or garages could affect traffic operations on adjacent roadways; however, impacts would be mitigated to No Build conditions. The potential for hide-and-ride parking exists (when transit users park in neighborhoods near transit stations), but in most areas the residential development is located far enough away from the stations that hide-and-ride parking would not likely be an issue.

The FWLE is anticipated to complement local bus service. As described in Chapter 3, Transportation, all but two transit routes are assumed to provide service in 2035, and other routes could be modified to provide more frequent service to better serve the study area and provide direct connections to light rail stations.

As described in Section 4.14, Public Services, Safety, and Security, crime around stations generally reflects the crime rates in the surrounding neighborhoods and the project would not increase crime rates. Sound Transit would also employ measures to minimize crime at the stations; therefore, safety and security impacts on adjacent neighborhoods are not anticipated.

Impacts by Alternative

SR 99 Alternative

The SR 99 Alternative would displace the fewest residences but the most businesses. While the effect on residential neighborhoods is limited, the alternative would displace businesses patronized by specific neighborhoods. There are suitable locations in the study area for business relocation, which would minimize this impact. The SR 99 Alternative would displace leased administrative offices at Highline College, but these offices would likely be relocated nearby. Visual changes along SR 99 would not affect adjacent neighborhood quality. Additional impacts associated with various station options are discussed below, except for the Federal Way SR 99 Station Option, where there would be no additional impacts.

S 216th Station Options

The potential additional station at S 216th Street (West option) would displace more businesses and be located close to residential development west of SR 99, but would not result in any additional neighborhood or community impacts. The East option would displace 26 units within a mobile home park south of S 216th Street and east of SR 99 that is for sale as of 2015]. This mobile home park has 75 units and a laundry facility. The potential additional station would not increase local traffic because parking is not provided at this station. Riders who use this station would be dropped off or picked up only, would transfer from the King County Metro Transit RapidRide A Line bus, or would use nonmotorized transportation such as walking or biking.

Kent/Des Moines Station Options

The Kent/Des Moines HC Campus Station Option would displace single-family residences south of Kent-Des Moines Road as well as a mobile home park in the Midway neighborhood. This option would result in visual impacts at residences adjacent to the alignment. Although this option would not create any social barriers because it would be located on the edge of the single-family neighborhood and behind the apartments that are currently adjacent to commercial uses, the loss of single-family residences in a cohesive neighborhood would have a greater effect on the neighborhood than the other Kent/Des Moines station options that would be located in more commercially developed areas with less neighborhood cohesion. The Kent/Des Moines HC Campus Station Option from S 216th West

Station Option would displace 4 additional mobile homes from a 20-unit mobile home park located north of Kent-Des Moines Road. This mobile home park is adjacent to commercial development on three sides and an apartment building, and is not part of a larger neighborhood.

The HC Campus Station Option would displace the Sea-Mar Community Health Center, which is a neighborhood and social amenity that serves both low-income and minority populations, with a focus on Hispanic populations. This facility could likely be relocated within the same general area in order to provide these services to the same population. If the HC Campus Station Option were combined with the S 216th West Station Option, it would also displace the Citadel Church and the Open Door Baptist Church. Both churches could probably relocate in the area.

The Kent/Des Moines SR 99 East Station Option would displace two mobile home parks. One of these parks consists primarily of motorhome recreational vehicles, which may be easier to relocate than the older mobile homes located at the other mobile home park. The Kent/Des Moines SR 99 Median Station Option would avoid impacts on the Sea Mar Community Health Center.

S 260th Station Options

The alignment for the potential additional station at S 260th Street (West option) would displace the Sea Mar Community Health Center described above, along with the Seattle Full Gospel Church and the Iglesia Cristiana Pentecostes Filidelphia. Relocation opportunities for all of these facilities are expected to be available in the study area. The East option would not result in any additional impacts.

S 272nd Redondo Trench Station Option

Relative to the SR 99 Alternative, the S 272nd Redondo Trench Station Option would be closer to single-family and multi-family residential developments west of SR 99 and would have visual quality impacts for residents north and south of Dash Point Road due to the proximity combined with vegetation removal. South of Dash Point Road, the alignment would be closer to Sacajawea Middle School and Park and Federal Way High School but would not result in additional impacts on these facilities. This alignment would not create any new barriers for residents adjacent to the alignment, and does not bisect any neighborhoods.

I-5 Alternative

The I-5 Alternative would be mostly within the WSDOT right-of-way and would not result in any new barriers because the alternative directly parallels I-5, which is already a barrier to access between neighborhoods. It would displace the most residences, mostly in multi-family buildings in the Pacific Ridge neighborhood, north of Kent-Des Moines Road where the alignment would be outside of WSDOT right-of-way. There are relocation opportunities in the study area. These displacements would not result in any impacts on the overall neighborhood quality because they would occur along the edge of the Pacific Ridge neighborhood. However, residences adjacent to the alignment would realize a change because of the removal of the adjacent residential buildings. The I-5 Alternative also requires the acquisition of two mobile home parks in the Midway neighborhood. Additionally, one mobile home would also be displaced on the eastern edge of the Camelot Square Mobile Home Park, south of S 288th Street. This mobile home park has approximately 400 units, a clubhouse, and an outdoor pool.

The I-5 Alternative would result in the fewest number of business displacements and it is not anticipated to affect any community facilities. There would be some visual changes on the edges of neighborhoods adjacent to I-5 where buildings and/or mature vegetation would be removed, but these impacts are not expected to affect neighborhood quality. Impacts from the Kent/Des Moines station options are discussed below. There would be no additional impacts from the Landfill Median Alignment Option or the Federal Way City Center station options.

Kent/Des Moines Station Options

The Kent/Des Moines At-Grade Station Option would not result in any additional impacts, and would have fewer residential displacements because the station would be located south of S 240th Street, thus avoiding impacts on some multi-family residences and both mobile home parks. The Kent/Des Moines SR 99 East Station Option would result in greater multi-family residential displacements than the I-5 Alternative. It would still involve the acquisition of two mobile home parks in the Midway neighborhood, although they would be different ones than the I-5 Alternative.

Federal Way City Center Station Options

The Federal Way I-5 Station Option would not have any additional neighborhood or community impacts, but the S 320th Park-and-Ride would displace 20 mobile homes on the east edge of the Belmor Park Golf & Country Club Manufactured Home Community. This mobile home park is a gated 55-and-up retirement community with approximately 300 units and several community amenities, including a golf course, indoor pool, library, exercise facility, and craft room.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would have similar impacts as the SR 99 Alternative north of Kent/Des Moines Road and the same as the I-5 Alternative south of S 240th Street. The Kent/Des Moines Station for this alternative would be located in the center of the Midway neighborhood. Residential displacements would include multi-family residences and two mobile home parks in the Midway area. Impacts for the station options that are associated with this alternative would be similar to those described for the I-5 Alternative.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would have similar impacts as the I-5 Alternative north of Kent/Des Moines Road and the same as the SR 99 Alternative south of S 240th Street. The Kent/Des Moines station for this alternative would be located in the center of the future Midway neighborhood, but would not affect any existing neighborhoods. Residential displacements unique to this alternative would be multi-family residences and two mobile home parks. Impacts for the station options that are associated with this alternative would be similar to those described for the SR 99 Alternative, except that the S 260th West Station Option would avoid the SeaMar Community Health Center because the guideway alignment would still be traveling west to SR 99 from I-5 in this location.

Indirect Impacts

The FWLE could have indirect effects on community cohesion and neighborhood quality. Station area improvements could provide new meeting places for nearby residents and employees, improving community cohesion.

The increased transportation options could make the neighborhoods adjacent to the light rail stations more attractive for commercial and residential redevelopment and for transit-oriented development

(TOD). Increased transit access and the potential for TOD could enhance walkability and safety of the neighborhoods. Refer to Section 4.2, Land Use, for information on TOD and applicable goals and policies.

Potential redevelopment in the station areas could also promote economic activity by expanding neighborhood business districts and could increase property values (refer to Section 4.3, Economics, for information on potential economic benefits). As a result, there is potential for increased property taxes in the station areas as property values increase with new development and as other properties are redeveloped. Increased property values could result in higher rents, and increases in property taxes could have a negative effect on existing home owners. Jurisdictions along the FWLE corridor have adopted goals and policies in their comprehensive plans related to the provision of affordable housing options. Sound Transit also has adopted a TOD Policy that includes goals for providing affordable housing in station areas.

4.4.5 Potential Mitigation Measures

Sound Transit would incorporate measures to minimize the impacts on neighborhood quality, social interaction, and safety and security. The FWLE would provide a net benefit to neighborhood quality during operation; therefore, no mitigation would be necessary beyond the mitigation described in other sections of this Draft EIS.

4.5 Visual and Aesthetic Resources

4.5.1 Summary

This section analyzes the potential for FWLE to change the visual quality of the surrounding area and how that affects sensitive viewers. In the study area, sensitive viewers are predominantly residents. In addition to this EIS section, more information is available in Appendix G5, Visual and Aesthetic Resources Technical Report. Key findings include:

- The elevated guideway of the SR 99 Alternative would impact the greatest number of sensitive viewers (residents) of the four alternatives.
- The I-5 to SR 99 Alternative would impact the second largest number of sensitive viewers because of tree removal near residences located west of, and adjacent to, I-5 north of Kent/Des Moines Road, as well as the presence of the elevated guideway in the median of SR 99 adjacent to residences south of S 240th Street.
- The SR 99 to I-5 Alternative would impact the third greatest number of sensitive viewers from residences along the SR 99 corridor north of Kent-Des Moines Road and from residences west of, and adjacent, to I-5 south of S 240th Street.
- The I-5 Alternative would impact the fewest number of sensitive viewers, though it would affects some viewers located in residences west of, and adjacent, to I-5.

Sensitive Viewers

Sensitive viewers refers to viewers where the landscape contributes to their enjoyment of their activity and aesthetic of their living environment. Park users or residents are more sensitive to change in the landscape than office workers or motorists.

Table 4.5-1 presents the number of residences affected by each alternative. With the potential mitigation measures suggested in Section 4.5.5 or similar design measures, fewer sensitive viewers would be impacted by the alternatives.

None of the station or alignment options would greatly reduce the number of residences impacted for that alternative. The Kent/Des Moines HC Campus Station Option would impact sensitive viewers along the west side of 28th Avenue S south of Kent-Des Moines Road, whereas the segment of the SR 99 Alternative it would replace would not affect residences. The S 272nd Redondo Trench Station Option would impact residents between S 279th Street and S 302 Street in similar numbers to the corresponding portion of the SR 99 Alternative. The remaining station and alignment options would not have additional impacts on residents.

TABLE 4.5-1
Number of Residences Near Alternative Corridors Where Visual Quality Would be Lowered

Alternative	Residences
SR 99	**215** (160-230)
I-5	**115** (1-115)
SR 99 to I-5	**130** (85-130)
I-5 to SR 99	**200** (190-200)

Note: The estimated number of residences indicated is a proxy for number of sensitive viewers that could be impacted.

4.5.2 Introduction to Resources and Regulatory Requirements

Visual and aesthetic environments are the landscape's natural and cultural features that can be seen and that contribute to the public's appreciation and enjoyment of their surroundings. The visual environment encompasses elements from both the built and natural environments. They can include solitary built and natural landmarks (such as buildings, trees, and bodies of water) or entire landscapes. Impacts on the visual and aesthetic environment are defined in terms of the extent to which the project's presence would change the visual character and quality of the environment.

The description of existing visual and aesthetic conditions in the corridor and the assessment of changes that would be associated with the FWLE are based upon, but do not strictly follow, the visual assessment methodology developed by the Federal Highway Administration (FHWA), which is described in Appendix G5, the Visual and Aesthetic Resources Technical Report prepared for this project (FHWA, 1988).

This evaluation reports on the potential for change to the existing visual quality and provides a comparison between the alternatives by providing the number of adjacent residential units oriented toward the area from which residents could potentially see changes. The other factors—view blockage of Puget Sound, the Olympic Mountains, and Mt. Rainier and impacts associated with light and glare—are assessed qualitatively.

The FWLE corridor was divided into three landscape units to organize the description of the affected environment and impact assessment. Landscape units are identifiable and distinct geographic areas within a linear project corridor from which there are views (the viewshed) of a proposed action (see Exhibits 4.5-1, 4.5-2, and 4.5-3).

Consistency of the FWLE alternatives with the plans, policies, and ordinances of the cities of SeaTac, Des Moines, Kent, and Federal Way regarding visual or aesthetic resources and/or scenic views was evaluated. None of the documents reviewed from these four cities identified protected views from specific locations, linear features (such as highways), or view corridors that were applicable to the alternatives being evaluated. Similarly, the Washington State Department of Transportation (WSDOT) has not designated areas of SR 99 or I-5 within the FWLE study area as scenic or recreational highways (WSDOT, 2014a).

4.5.3 Affected Environment

The study area for visual and aesthetic resources is the viewshed of the alternatives being evaluated. Due to the presence of vegetation, terrain, and buildings, which can constrain views of the alternatives from many locations within the study area, the viewshed for the FWLE is generally between approximately 200 to 500 feet from the alternatives.

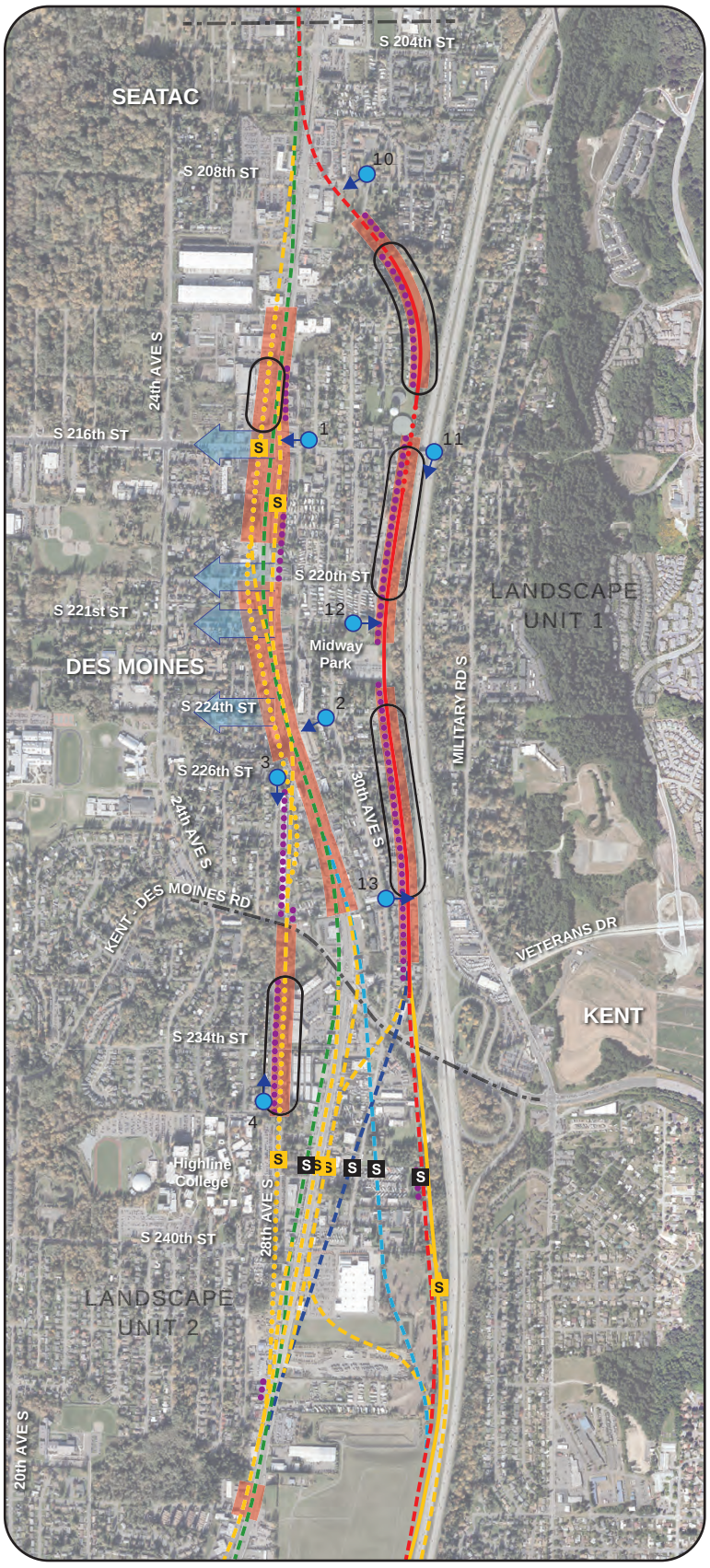
The description of the affected environment focuses on the landscape character and visual quality, viewer sensitivity, and views of Puget Sound, the Olympic Mountains, and Mt. Rainier by landscape unit. As indicated above in Section 4.5.2, no specific protected views were identified in plans or policies developed by cities within the FWLE corridor. However, during site visits and conversations with staff from these cities, westward views of Puget Sound and the Olympic Mountains from parts of the SR 99 corridor and of Mt. Rainier from a portion of the I-5 corridor were identified as important features to these communities, therefore views of features are described. The general locations of areas with views of Puget Sound, the Olympic Mountains, and Mt. Rainier that could be affected by the project are identified in Exhibits 4.5-1 to 4.5-3.

Factors that Contribute to Visual Quality

Vividness is the degree of drama, memorability, or distinctiveness of the landscape components. Vividness is composed of four elements—*landform, vegetation, water features, and human-made elements*—that usually influence the degree of vividness.

Intactness is a measure of the visual integrity of the natural and human-built landscape and its freedom from encroaching elements. Intactness is composed of two primary elements—*development and encroachment*—that influence the degree of intactness.

Unity is the degree of visual coherence and compositional harmony of the landscape when it is considered as a whole. High unity frequently attests to the careful design of individual components and their relationship in the landscape.



Legend

SR 99 Alternative
- Elevated

I-5 Alternative
- Elevated
- At-Grade
- Trench

SR 99 to I-5 Alternative
- Elevated

I-5 to SR 99 Alternative
- Elevated

Options
- Elevated
- At-Grade
- Trench

Stations
- S — Station for Alternatives
- S — Station for Options
- Landscape Unit Boundary
- Area with Views of Puget Sound, the Olympic Mountains, or Mt. Rainier
- Area with Concentration of Sensitive Viewers
- 5 — Key Observation Point and View Direction
- Average Visual Quality

Note: Portions of Alternative Corridors Not Categorized as Average Visual Quality Are Categorized as Low Visual Quality

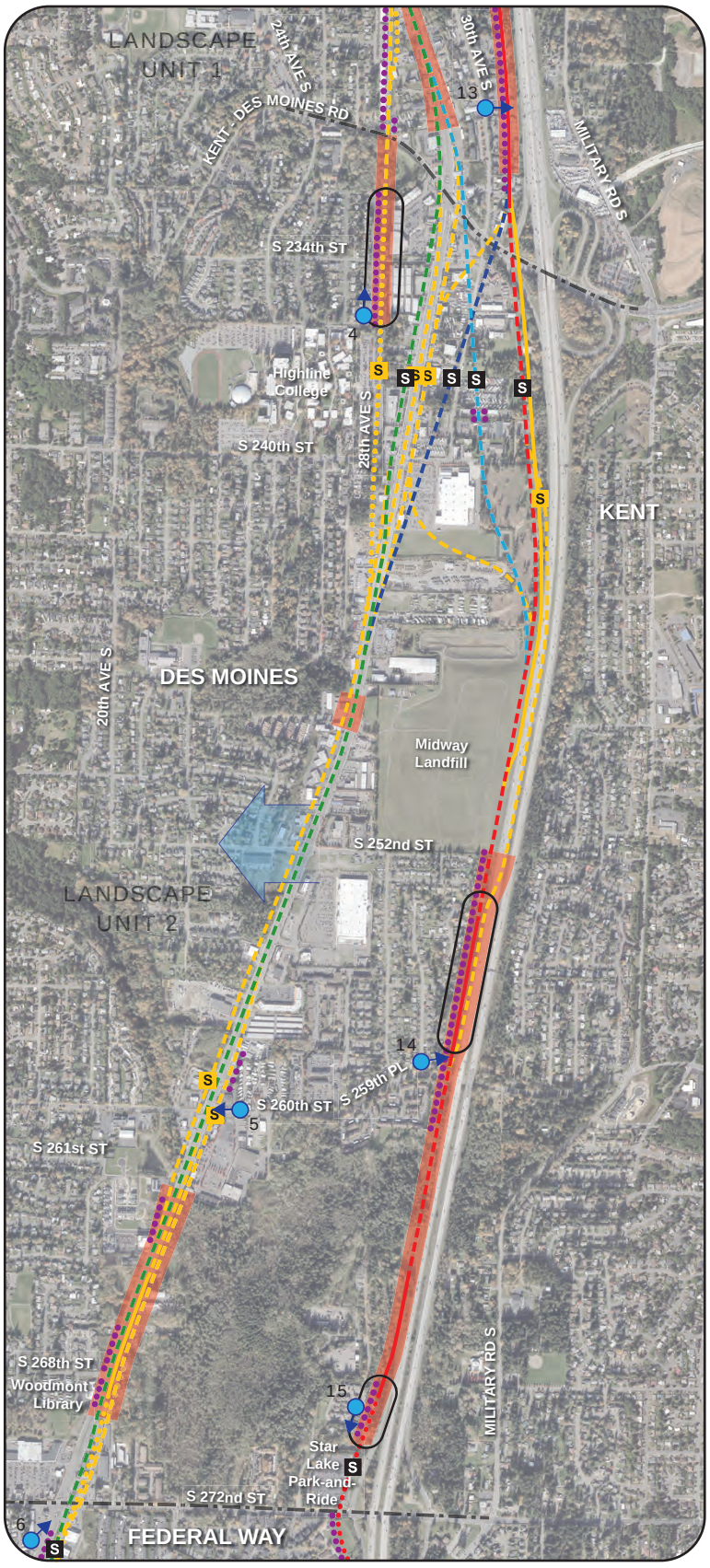
- Location Where Visual Quality Would Be Lowered Adjacent to Areas with Concentration of Sensitive Viewers

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013).

N

0 0.25 0.5 Mile

EXHIBIT 4.5-1
Visual Conditions in Landscape Unit 1
Federal Way Link Extension



Legend

SR 99 Alternative
- Elevated

I-5 Alternative
- Elevated
- At-Grade
- Trench

SR 99 to I-5 Alternative
- Elevated

I-5 to SR 99 Alternative
- Elevated

Options
- Elevated
- At-Grade
- Trench

Stations
- Station for Alternatives
- Station for Options
- Landscape Unit Boundary
- Area with Views of Puget Sound, the Olympic Mountains, or Mt. Rainier
- Area with Concentration of Sensitive Viewers
- Key Observation Point and View Direction
- Average Visual Quality

Note: Portions of Alternative Corridors Not Categorized as Average Visual Quality Are Categorized as Low Visual Quality

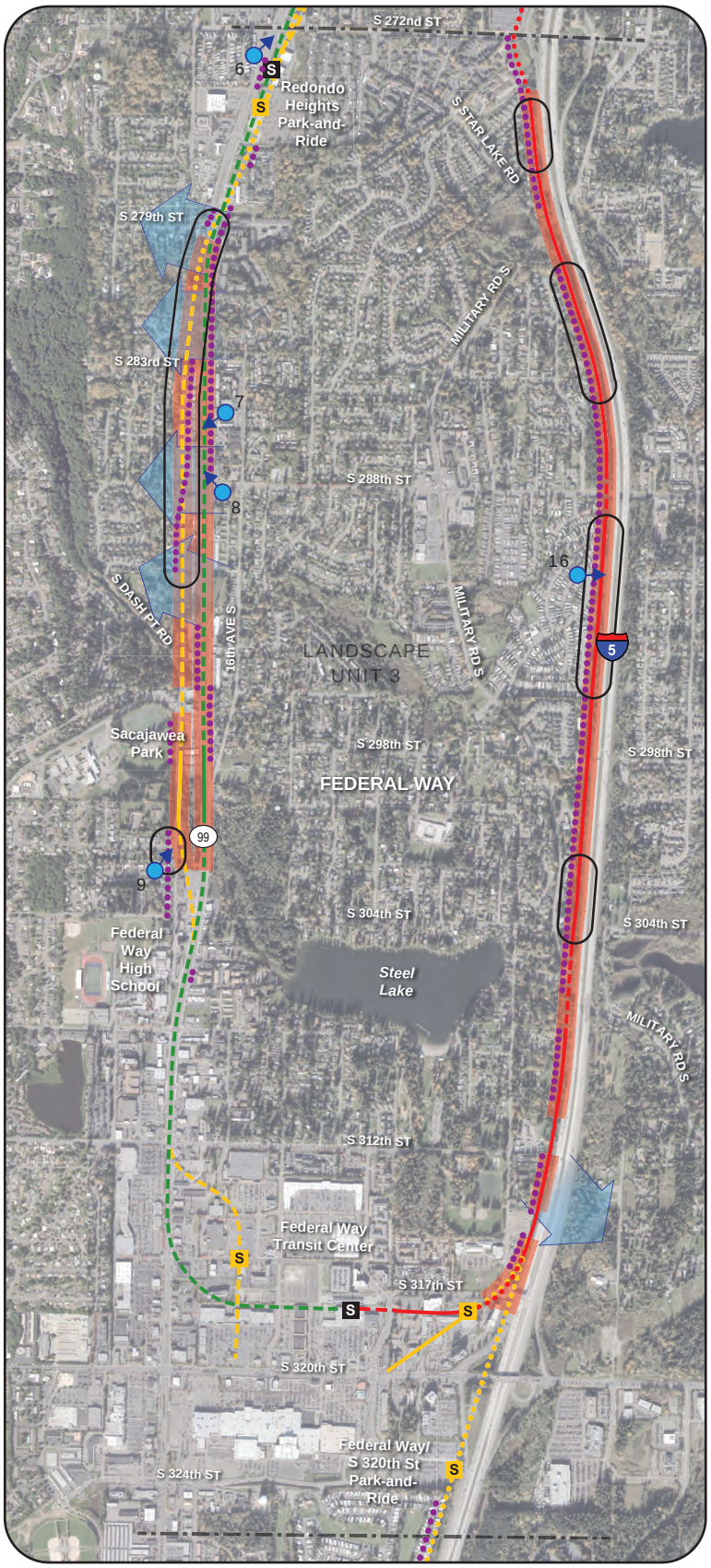
- Location Where Visual Quality Would Be Lowered Adjacent to Areas with Concentration of Sensitive Viewers

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013).

N

0 0.25 0.5 Mile

EXHIBIT 4.5-2
Visual Conditions in Landscape Unit 2
Federal Way Link Extension



Legend

SR 99 Alternative

- Elevated

I-5 Alternative

- Elevated
- At-Grade
- Trench

SR 99 to I-5 Alternative

- Elevated

I-5 to SR 99 Alternative

- Elevated

Options

- Elevated
- At-Grade
- Trench

Stations

- S — Station for Alternatives
- S — Station for Options
- Landscape Unit Boundary
- Area with Views of Puget Sound, the Olympic Mountains, or Mt. Rainier
- Area with Concentration of Sensitive Viewers
- 5 — Key Observation Point and View Direction
- Average Visual Quality

Note: Portions of Alternative Corridors Not Categorized as Average Visual Quality Are Categorized as Low Visual Quality

- Location Where Visual Quality Would Be Lowered Adjacent to Areas with Concentration of Sensitive Viewers

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013).

N

0 0.25 0.5 Mile

EXHIBIT 4.5-3
Visual Conditions in Landscape Unit 3
Federal Way Link Extension

Landscape character is an objective assessment of a landscape view that is composed of various natural and human-built elements. Visual quality is an assessment of the composition of character-defining features of selected views. Under the FHWA visual quality analysis methodology, the visual quality of viewed landscapes are determined and evaluated in terms of vividness, intactness, and unity. Establishing visual quality categories assists in assessing changes in the visual environment that would occur with the various alternatives and options. Visual quality was categorized as low, average, or high in order to describe the existing visual quality along the FWLE alternatives and options. The visual quality ranking was also used in evaluating potential impacts associated with the alternatives. Exhibits 4.5-1, 4.5-2, and 4.5-3 depict the existing visual quality categories of the corridors the FWLE alternatives and options would pass through. There were no areas of high visual quality in the study area. Areas not highlighted as average on these exhibits are categorized as low visual quality.

Visual Quality Categories

Low Visual Quality: Areas with low visual quality have some combination of features that seem visually out of place, lack visual coherence, do not have compositional harmony, and/or might contain eyesores.

Average Visual Quality: Areas with average visual quality are commonly occurring or average-appearing landscapes that have a generally pleasant appearance but might lack enough distinctiveness, memorability, drama, and compositional harmony to place them in the high visual quality category. This is generally the most frequent category.

High Visual Quality: Areas with high visual quality must be outstanding in terms of being very memorable, distinctive, unique (in a positive way), and/or intact—they can be natural, park-like, or urban (with urban areas displaying strong and consistent architectural and urban design considerations).

Sensitive viewers refers to viewers where the landscape contributes to their enjoyment of their activity and aesthetic of their living environment. Park users or residents are more sensitive to change in the landscape than office workers or motorists.

4.5.3.1 SR 99 Corridor

The character of the six-lane SR 99 corridor is typical of major arterial transportation corridors where automobile-oriented commercial development has evolved over the last several decades (see Section 4.2, Land Use, for a more detailed description of land uses along SR 99). The wide variety of land uses along the SR 99 corridor include many large-scale, low-rise commercial, manufacturing, and storage buildings with extensive paved areas for parking or storage that do not support visual order, intactness, or unity. As a result, large parts of the SR 99 corridor have a utilitarian appearance and a visual quality category of low. As areas along the SR 99 corridor develop, redevelop, or receive additional streetscape improvements, the character of the corridor has and will continue to evolve from large-scale commercial, “strip mall” commercial, and undeveloped, to residential and/or office and smaller commercial. Visual quality is expected to improve as this development occurs. Areas that in past years would have been considered to have low visual quality have improved in recent years,

and portions of the SR 99 corridor are categorized as having average visual quality (see Exhibits 4.5-1 to 4.5-3).

4.5.3.2 I-5 Corridor

I-5's eight travel lanes, center divider, shoulder, cleared area adjacent to the shoulder, and vegetated areas beyond are typical of major interstate highways. Where I-5 can be seen from adjacent areas, its presence greatly influences the character of views. Most of the neighborhoods adjacent to I-5 are visually screened from the freeway by vegetation and/or sound walls. Vegetation along the edge of I-5 serves as a distinctive backdrop for many adjacent neighborhoods. Most of the residences west of I-5 are oriented away from the freeway. As depicted in Exhibits 4.5-1, 4.5.2, and 4.5-3, the visual quality of much of the I-5 corridor as viewed from nearby areas is average. Some multi-story buildings at the south end of the I-5 FWLE corridor have balconies that face east towards I-5 and include views of Mt. Rainier. The area west of I-5 (where the I-5 Alternative would be constructed) contains mature vegetation. These vegetated areas are not uncommon in the greater Seattle metropolitan area, but do offer visual relief from the large infrastructure of the freeway.

4.5.4 Environmental Impacts

The three factors listed below were used to determine whether the alternatives being evaluated would result in impacts to visual and aesthetic resources:

- Change to the visual quality of the corridors of the alternatives near areas with concentrations of sensitive viewers (mostly residents);
- Potential blockage or intrusion on existing views of Puget Sound, the Olympic Mountains, or Mt. Rainier; and/or
- Impacts associated with light and glare related to stations, parking areas, and trains.

4.5.4.1 No Build Alternative

With the No Build Alternative, changes to the landscape would be limited to minor improvements of existing roadways and private development along the corridor. As individual properties redevelop over time, changes to the visual environment would occur incrementally. Westward views of Puget Sound and the Olympic Mountains from SR 99 might change over time if properties on the west side of SR 99 are redeveloped to their currently allowed zoning

heights (between 35 and 200 feet, depending upon location specific zoning).

4.5.4.2 Build Alternatives

This section discusses the potential visual impacts from permanent features of the FWLE. Short-term visual impacts during construction are described in Chapter 5, Construction Impacts. The FWLE alternatives were developed with consideration given to minimizing potential visual impacts. The minimization measures listed below were included during conceptual design to avoid and minimize impacts:

- Selecting and/or modifying alignments to avoid or reduce the need to acquire and clear new right-of-way. This measure has already been incorporated to a great degree in identifying alignment alternatives and station options and includes using existing transportation corridors (arterial streets and highways, limited-access highways) and a utility corridor.
- Minimizing the elevation or height of elevated structures and stations to the extent allowed by required vertical clearances.
- Incorporating trench and at-grade profiles where possible to eliminate the need for elevated structures, resulting in cost savings and reduced visual and aesthetic impacts.
- Minimizing clearing for construction and operation.
- Maintaining surplus property for redevelopment by other parties.

4.5.4.3 Direct Impacts

Visual simulations were developed for key observation points (KOPs) to depict the conceptual design of the FWLE alternatives and options and are included in Appendix C of the Visual and Aesthetic Resources Technical Report (Appendix G5). The simulations provide readers with an idea of the expected scale and general appearance of the alternatives and options. Although some simulations indicate general areas where mitigation such as vegetative screening or sound walls might be appropriate, they do not specifically depict the mitigation measures described in Section 4.5.5, Potential Mitigation Measures. Sound walls and landscaping that are shown in the simulations are conceptual in size and location. Details related to these measures would be developed during final design and

Key Observation Points

Sound Transit, in consultation with local jurisdictions, selected 16 site-specific locations, or key observation points (KOPs), from which to take photographs showing existing visual conditions. Those photographs were used to develop photographic simulations to (1) illustrate how existing visual characteristics of areas where the proposed project would be located would change with FWLE alternatives and options, (2) assist in evaluating changes to visual quality, and (3) depict areas where project components could potentially intrude upon, or block, views of Puget Sound, the Olympic Mountains and Mt. Rainier.

would include input from the community and cities in the FWLE project corridor.

Impacts Common to All Build Alternatives

All of the FWLE alternatives and options would change the visual environments in which they would be constructed. The FWLE alternatives and options would require the removal of a variety of existing visual features such as buildings, street trees, landscaped areas, slopes, and parking lots. Some streets would require widening, and others would require bridging structures where the alternative would pass beneath them in a trench. Table 3-1 in Appendix G5 identifies the main components of the FWLE and describes their visual characteristics.

Although the evaluation focuses on impacts to residents, who are considered sensitive viewers, the visual changes from the FWLE alternatives and options would also be seen by other viewers such as workers, customers, and motorists. These additional views would see changes associated with the alternatives and options from buildings, sidewalks, and roadways. In addition to current viewers, people in the future who would be riding light rail trains as passengers would also be viewers and would have views from the proposed project. Along sections of elevated guideways and stations, passengers would have elevated views of the surrounding areas that could be quite extensive and, in some places, scenic.

Given the developed nature of areas in the vicinities of the potential stations and the mitigation measures described in Section 4.5.3, the presence of the lights at the stations and parking areas would not affect sensitive viewers (primarily residents). Headlights from passing trains are directed forward and downward to the guideway. While the train headlight on the elevated guideway may be visible to some, it is likely that sound walls (which would be located on alignments adjacent to residential areas) would block the train headlights and most of the interior lights depending upon the height and placement of the sound wall. The presence of passing trains at night would be brief, but might disturb some sensitive viewers, although similar lights from vehicles passing by along SR 99, I-5, or other arterials are currently seen along many of the alternative alignments.

Impacts by Alternative

Table 4.5-2 provides a summary by landscape unit of the number of residences from which residents would see a reduction of visual

quality by alternative. Locations where these impacts would occur are described in this section, but areas where impacts would not occur are not discussed. Areas where station or alignment options associated with the alternatives would change the number of residences affected are also described.

TABLE 4.5-2
Approximate Number of Residences Near Alternative Corridors Where Visual Quality Would be Lowered By FWLE Alternative

Landscape Unit	Potential Number of Residences where Nearby Visual Quality Would be Reduced			
	SR 99 Alternative	I-5 Alternative	SR 99 to I-5 Alternative	I-5 to SR 99 Alternative
Landscape Unit 1: S 200th Street to Kent-Des Moines Road	45	30	45	30
Landscape Unit 2: Kent-Des Moines Road to S 272nd Street	0	15	15	0
Landscape Unit 3: S 272nd Street to Federal Way Transit Center	170	70	70	170
Total All Landscape Units	**215**	**115**	**130**	**200**

Note: The estimated number of residences indicated is a proxy for number of sensitive viewers that could impacted.

SR 99 Alternative

The SR 99 Alternative elevated guideway would be larger in height than most structures on adjacent lands. However, it would not be inconsistent with the utilitarian character of portions of the corridor, which are adjacent to large-scale low-rise commercial and industrial buildings that are surrounded by expansive paved areas for vehicle parking or storage. Most of these areas have low visual quality and do not contain sensitive viewers; the SR 99 Alternative would not reduce visual quality in these areas. In residential areas (primarily multi-story residential buildings) that have average visual quality, the SR 99 Alternative elevated guideway would be generally out of scale and would reduce the visual quality of the SR 99 corridor to low. Exhibits 4.5-1 through 4.5-3 show the affected areas.

Future Development along SR 99

As properties along the west side of SR 99 redevelop over time, views of Puget Sound and the Olympic Mountains from SR 99 and areas east of SR 99 could be impacted. For example, areas on the west side of SR 99 in the vicinity of S 216th Street have been zoned Pacific Ridge Commercial 2 (PR-C2). This zone allows a maximum height of 75 feet, except for 1-acre parcels where buildings as tall as 200 feet can be built if a floor area ratio height bonus is approved. As these properties redevelop over time, it is likely that views of Puget Sound and the Olympic Mountains from SR 99 and areas east of it could be restricted to road corridors like those near S 216th Street and S 224th Street.

The SR 99 Alternative would require portions of landscaped medians be removed for guideway support columns and/or turn lanes. Where medians that currently contain landscaping would be affected, existing vegetation would be preserved or replaced where feasible with smaller trees or shrubs. These landscaped

medians would be replanted in consultation with local jurisdictions and could take several years to for plantings to mature.

Landscape Unit 1

In Landscape Unit 1, the elevated structure would not be consistent with the residential character of the area on the east side of SR 99 directly north of S 216th Street and would reduce the average visual quality of this part of the SR 99 corridor to low.

The guideway would also intrude on views of Puget Sound and the Olympic Mountains seen from some of the residences, as well as views of these features from some areas east of SR 99 (see KOP 1, Exhibit 1b**,** and KOP 2, Exhibits 2b-1 and 2b-2, in Appendix G5).

Landscape Unit 2

Although there are some areas with concentrations of sensitive viewers adjacent to areas with average visual quality in Landscape Unit 2, the elevated guideway would not lower visual quality enough to reduce it from average to low.

Landscape Unit 3

In Landscape Unit 3, the elevated guideway would pass a series of residential areas adjacent to parts of the SR 99 corridor that have average visual quality. Most of the residential areas are found along the east side of SR 99 and consist of multi-story buildings that have been constructed on terrain higher than SR 99. Some isolated areas in Landscape Unit 3 contain single-family residences and mobile homes that are generally at the same elevation as SR 99. The scale and presence of the elevated guideway above the median in these residential areas would not be consistent with the residential character and would reduce the average visual quality of these areas to low (see Table 4.5-2). The elevated guideway would also intrude on, or block, views of Puget Sound and the Olympic Mountains from some areas along this section of the SR 99 corridor (see KOPs 7 and 8, Exhibits 7b and 8b, in Appendix G5).

SR 99 Alternative Station Options

The following paragraphs discuss the options associated with the SR 99 Alternative that would result in a lowering of visual quality near residential areas, or that would avoid lowering of visual quality relative to the elevated median alternative. Options not discussed would not result in a reduction in visual quality change in relative to the SR 99 Alternative.

S 216th West Station Option

The potential additional station (west option) would be west of SR 99 in a trench that would pass under S 216th Street. The guideway leading to and from the station would be in a trench that would be adjacent to an area with residential viewers on the east side of SR 99 that is north of S 216th Street. This option would avoid the SR 99 Alternative visual impacts to these sensitive viewers.

S 216th East Station Option

The elevated guideway leading into the S 216th Street East Station Option would pass within approximately 40 feet of the southern-most of three multi-story residential buildings north of S 216th Street and east of SR 99. The elevated structure would reduce the average visual quality of this part of the SR 99 corridor to low and intrude on, or block, views of Puget Sound and the Olympic Mountains. These impacts would also occur with the SR 99 Alternative and this option would not increase impacts. The location of the light rail, however, would be closer to these residences and would intensify impacts.

Kent/Des Moines HC Campus Station Option

The Kent/Des Moines HC Campus Station Option would not have any impacts in Landscape Unit 1 and does not extend into Landscape Unit 3. In Landscape Unit 2, this option would pass along the edge of a residential neighborhood and would require the removal of all residences on the east side of 28th Avenue S (see KOP 4, Exhibit 4b, in Appendix G5). The removal of the residences and associated vegetation, along with the presence of the sound wall, overhead catenary system, and the tops of trains, would not be consistent with the residential character of this area. These features would decrease the intactness and unity of 28th Avenue S and would decrease the average visual quality of this part of the option alignment to low. South of the residences, the alignment would continue in a trench to the HC Campus Station. If landscaping and sound walls were implemented next to the portion of the trench along 28th Avenue S that would be adjacent to residences, visual quality could be restored to average after several years, as plants matured. The Kent/Des Moines HC Campus Station Option would impact approximately 15 additional residences relative to the SR 99 Alternative.

S 272nd Redondo Trench Station Option

The S 272nd Redondo Trench Station Option would be located in Landscape Units 2 and 3 and would pass next to several residential areas (see Exhibits 4.5-1 to 4.5-3). It would first pass east of (and uphill from) single-family residences north of S 284th Street where the cleared right-of-way would remove vegetation between the residences and SR 99. From approximately S 284th Street to Dash Point Road the S 272nd Redondo Trench Station Option would be on an elevated guideway and would pass between a series of residential areas. It would travel west (and downhill from) multi-story residential buildings on the west side of SR 99 and east of (and uphill from) several areas containing single-family residences. The presence of the cleared right-of-way and elevated guideway would be inconsistent with the residential character for these portions of the option. Between S 279th Street and Dash Point Road, the elevated guideway would be seen (beyond the residences west of SR 99) from some units in a series of multi-story residential buildings that line the east side of SR 99. The presence of the option would not be consistent with the residential character of the corridor seen by residents in the multi-story residential buildings. The potential mitigation measures identified in Section 4.5.5 would be somewhat effective within 5 to 8 years (as vegetation matured) in mitigating impacts to residential areas adjacent to the at-grade portions of the option, but would not mitigate the impacts of the elevated sections, which would lower visual quality.

South of Dash Point Road, the removal of vegetation along the east side of 16th Avenue S would be noticed, as would passing trains and a sound barrier. The average visual quality of the portion of the alignment along 16th Avenue S would be reduced to low. With mitigation measures, the visual quality of views along 16th Avenue S would be restored to average (see KOP 9, Exhibit 9b, in Appendix G5). When compared to the SR 99 Alternative, however, this option would reduce the total number of residential units impacted by approximately 10.

I-5 Alternative

The greatest potential impact from the I-5 Alternative would be the removal of trees along the west side of I-5 and, in some portions of the alternative, the removal of residences in neighborhoods west of I-5. Although motorists other than those engaged in sight seeing are

considered to have moderate to low viewer sensitivity, the removal of trees would change motorists' experience driving on I-5 (see KOP 11, Exhibit 11b, in Appendix G5), and some would likely experience decreased driving pleasure. In addition to removing vegetation within the construction footprint, potentially dangerous trees outside of the construction footprint that might fall onto the guideway could be removed after consultation with an arborist, possibly including some on private property. The I-5 Alternative would remove approximately 35 acres of vegetation. The loss of trees would result in the FWLE elements being visible from some adjacent properties and by motorists on I-5. The removal of trees in the I-5 corridor would change the character of the corridor to that of a more urbanized environment with less tree canopy. WSDOT manages and maintains areas beyond interstate rights-of-way that are not required for operation of the interstate as buffers that may contain mature native vegetation. These areas are called Beautification Areas and Landscape Areas and are discussed in more detail in Appendix G5, the Visual and Aesthetic Resources Technical Report. Approximately 0.1 acre of Landscape Area would be impacted by the I-5 Alternative. The WSDOT *Roadside Policy Manual* (WSDOT, 2014b) provides policy requirements regarding removing and replacing trees within and adjacent to a highway right-of-way such as I-5.

While changes associated with the I-5 Alternative may be seen from more distant residences, the impacts would generally be experienced by adjacent residences. Because most of the neighborhoods west of the I-5 corridor are single-family neighborhoods and contain considerable mature vegetation and numerous buildings, views towards the I-5 Alternative within the neighborhood beyond residences adjacent to the I-5 Alternative would tend to be screened or blocked by vegetation and buildings. Where properties west of I-5 become more visible from I-5 due to vegetation removal, views of urbanized uses (primarily residential) would replace views of forested areas.

Landscape Unit 1

In Landscape Unit 1, construction of the I-5 Alternative would require the removal of a number of single-family and multi-story residential buildings, as well as of vegetation along the west side of I-5. Removing residences and/or vegetation for the I-5 Alternative would expose residences between S 211th Street and the Kent-Des Moines

Road to largely uninterrupted views of the elevated and at-grade portions of the I-5 Alternative. Even though I-5 is nearby and apparent, the presence of elevated and at-grade alignments would not be consistent with the residential character of these areas. These changes would reduce the existing average visual quality in this area to low and impact nearby residents (see Table 4.5-2 and Exhibits 4.5.1 to 4.5-3).

Landscape Unit 2

In Landscape Unit 2, the I-5 Alternative would pass a large residential area between approximately S 252nd Street and S 259th Street. Much of the mature vegetation along I-5 near these areas would be removed. The presence of the elevated and at-grade guideway and passing trains would not be consistent with the residential character of this area. The average visual quality of this part of the I-5 Alternative corridor would be reduced to low. The I-5 Alternative would also pass by a smaller residential area accessed via 28th Avenue S, north of the Star Lake Park-and-Ride. Residences on the east side of 28th Avenue S would be removed, along with most of the trees between these residences and I-5. These changes would be visible to some residences to the west of 28th Avenue S and the existing average visual quality in this area would be reduced to low, impacting nearby residents (see Table 4.5-2).

Landscape Unit 3

In Landscape Unit 3 between S 272nd Street and S 288th Street, the I-5 Alternative would require the removal of most of the trees along the western edge of I-5. The elevated and transitioning-to-at-grade guideway would not be consistent with the adjacent residential character and would reduce the existing visual quality of the portion of the corridor between S 272nd Avenue and S 288th Street from average to low next to nearby residences (see Table 4.5-2). South of S 288th Street, the removal of the trees and replacement of the existing sound wall would be noticed from residences in a mobile home park that have views towards I-5 (see KOP 15, Exhibit 15b, in Appendix G5). The removal of trees and presence of the retained-fill wall and sound walls would reduce the average visual quality of the corridor to low and impact nearby residents' views.

The mitigation measures discussed in Section 4.5.5 related to landscaping and sound walls would help reduce visual impacts from the I-5 Alternative on nearby residential areas. Near at-grade sections

of the I-5 Alternative, these measures could restore visual quality to average after several years, as plants matured. The I-5 Alternative would not intrude upon views of Mt. Rainier.

None of the I-5 Alternative station and alignment options would lower the existing visual quality adjacent to sensitive viewing areas and therefore are not described in this section.

SR 99 to I-5 Alternative

Between the Angle Lake Station and approximately S 240th Street, the SR 99 to I-5 Alternative would be the same as the SR 99 Alternative and would pass through areas with low visual quality and/or would not travel near areas with concentrations of sensitive viewers. There would be no visual impacts between Kent-Des Moines Road and S 240th Street. South of S 240th Street, this alternative would follow the I-5 Alternative alignment and have the same reductions in visual quality to portions of its corridor next to areas with concentrations of sensitive viewers in Landscape Units 2 and 3 (see Table 4.5-2). There would be no additional impacts from station or alignment options.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would have the same impacts to residents in Landscape Unit 1 as the I-5 Alternative. There would be no reduction in visual quality categories along the corridor near areas with residents between Kent-Des Moines Road and S 240th Street. After reaching the SR 99 median south of S 240th Street, the change in visual quality for the portion of the I-5 to SR 99 Alternative near residents would be the same as that of the SR 99 Alternative in Landscape Unit 3 (see Table 4.5-2). Visual changes from the S 272nd Redondo Trench Station Option would be the same as described under the SR 99 Alternative.

4.5.4.4 Indirect Impacts

The FWLE could support changes to nearby land uses, as allowed in adopted plans, and increases in the density of development could occur. This might result in changes to the visual setting of the areas where the FWLE would create changes.

4.5.5 Potential Mitigation Measures

In addition to the avoidance and minimization measures described in Section 4.5.4.2, supplemental measures might be appropriate to reduce visual impacts of the FWLE alternatives at various locations, particularly near residential areas. Areas where visual quality would

be lowered near residential areas are identified in Exhibits 4.5-1 to 4.5-3. These areas are places where some of the potential mitigation measures would be appropriate and successful in reducing impacts. Specific locations where mitigation would be appropriate would be determined in consultation with local jurisdictions, as alignment designs are refined.

Most of the potential mitigation measures identified below are related to the placement and design of the light rail facilities, or the use of landscaping or other features to help screen or soften views of facilities.

- Where Sound Transit may need to acquire property beyond the footprint of light rail facilities, particularly in residential areas, there might be opportunities for additional landscaping and buffers to screen views of the facilities from adjacent neighborhoods. Where buildings would be removed, appropriate vegetation could be planted in order to provide screening of FWLE facilities or to screen areas exposed by the removal of the residences.
- In areas where the elevated guideway would remove existing landscaped medians for guideway columns, Sound Transit could replace landscaping between the guideway columns. The type of vegetation may be different; for example, shorter species may be planted because the existing species of trees in the median would grow too tall to fit underneath the elevated structure.
- Tree removal along the I-5 corridor (both within and outside of WSDOT Landscape Areas) would be minimized and would be mitigated according to the WSDOT *Roadside Policy Manual*.
- Where retaining walls are required, they could include landscaped areas, where practical, that would soften their appearance when viewed from adjacent residential neighborhoods. Retaining walls, at-grade sound walls, or other major structural elements near areas with concentrations of visually sensitive viewers could be designed with visually interesting elements, such as design treatments that incorporate texture, patterns, and color.
- Stations and park-and-ride facilities could include context sensitive design and islands of landscaping within areas of pavement and around their perimeter as required by local codes.

- Exterior lighting at stations and park-and-ride lots would be designed to minimize height and use source shielding to avoid luminaries (bulbs) that would be directly visible from residential areas, streets, and highways. Shielding would also limit spillover light and glare in residential areas.
- Architectural aspects of the FWLE, where visible from I-5, would be coordinated in color, texture, and materials to be consistent with the existing architectural features in the corridor.

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4.6 Air Quality and Greenhouse Gases

4.6.1 Summary

This air quality and greenhouse gas analysis provides information regarding potential impacts on air quality associated with the Federal Way Link Extension (FWLE).

Due to mandated improvements in fuel efficiency over the next 20 years, transportation emissions are expected to be reduced from existing conditions with both the No Build Alternative and build alternatives. King County is a "maintenance" area for carbon monoxide (CO). Regardless of the FWLE alternative chosen, CO concentrations would not exceed the National Ambient Air Quality Standards (NAAQS) for CO. Because the FWLE is included in the Regional Transportation Improvement Program (RTIP) and would not exceed the CO NAAQS, the project would conform with the regional air quality maintenance plan.

Air Quality Attainment and Maintenance Areas

When a region meets the air quality standard for a given pollutant, it is designated as being in "attainment" for that pollutant. If it does not meet the air quality standard, it is designated as being in "nonattainment." Areas once designated as nonattainment areas that now meet the standard are designated "maintenance" areas. Areas with insufficient data to designate the area or where the designations have yet to be made are "unclassified."

For all the build alternatives, mobile source air toxics (MSATs) emissions within the FWLE corridor are expected to be lower than existing levels and the No Build Alternative due to continued improvements resulting from the United States Environmental Protection Agency's (EPA) national control programs. As a result, the FWLE would generate minimal air quality impacts for Clean Air Act (CAA) criteria pollutants and would not be linked with any special MSAT concerns. Consequently, MSATs impacts are not expected to occur as a result of the FWLE.

Greenhouse gas emissions are estimated to decrease from existing conditions for the 2035 No Build and build alternatives. All build alternatives would result in a reduction in vehicle miles traveled (VMT) that would lower greenhouse gas (GHG) emissions within the project corridor. However, the light rail system's consumption of electricity for each build alternative would indirectly add GHG emissions related to energy production outside the project corridor.

Appendix D4.6 presents information on air quality standards and modeling results.

4.6.2 Introduction to Resources and Regulatory Requirements

The FWLE corridor is located in south King County under the jurisdiction of the Puget Sound Clean Air Agency (PSCAA) for local air

quality regulation. Air quality in the Puget Sound Region is regulated and enforced by federal, state, and regional agencies—the EPA, Washington State Department of Ecology (Ecology), and PSCAA—each with its own role in regulating air quality.

This section discusses the applicable regulatory framework for the Puget Sound Region, describing the existing attainment status with established air quality standards in the project vicinity for each regulated pollutant.

4.6.2.1 Ambient Air Quality Standards

Criteria Pollutants

EPA's NAAQS (EPA, 2012a) set limits on concentration levels of certain pollutants, commonly referred to as the "criteria pollutants." The six criteria pollutants are:

- carbon monoxide
- particulate matter less than 10 microns in diameter (PM_{10})
- particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)
- ozone (O_3)
- sulfur dioxide
- lead
- nitrogen dioxide

The NAAQS for these criteria pollutants are separated into two standard categories: the primary and the secondary standards (40 Code of Federal Regulations [CFR] 50). The primary standards were created to protect public health; the secondary pollutant standards were established to protect public welfare and the environment. Air quality is monitored and areas are designated according to whether or not they meet the NAAQS for each pollutant.

Washington State has established Washington Ambient Air Quality Standards (WAAQS) (Washington Administrative Code [WAC] 173-470, 474, and 475). PSCAA also adopted air quality standards for the Puget Sound Region. Table D4.6-1 in Appendix D4.6 lists the NAAQS, WAAQS, and PSCAA-adopted air quality standards for the criteria pollutants.

Transportation Conformity Requirements

Under the CAA, a transportation project located in a nonattainment or maintenance area is required to meet a conformity determination with the SIP. Conformity requirements are met when a project does not cause or contribute to an exceedance of the NAAQS. In air quality maintenance areas, regionally significant projects are evaluated for their conformity to air quality maintenance plans. Projects that conform to the plan are not expected to cause exceedances of the standard. In the Puget Sound Region, PSRC determines regional conformity by including a project in the Metropolitan Transportation Plan (MTP) and the RTIP. Transit projects are not governed by state requirements; however, state requirements are referenced as guidance to demonstrate project conformity when transit projects have an effect on traffic patterns on local roadways.

King County is a maintenance area for CO. Therefore, the project is subject to transportation conformity requirements and needs to demonstrate conformity at both regional and project levels for CO. The project is in an attainment area for all other criteria pollutants (including PM_{10} and $PM_{2.5}$); therefore, analysis of the other criteria pollutants is not required.

Air Quality Conformity

Regional conformity is demonstrated if the project is included in a financially constrained conforming regional transportation plan and a regional transportation improvement program. Project-level conformity is demonstrated when three conditions are met:

- The project is listed in a conforming regional transportation plan and regional transportation improvement program.
- The project does not cause or contribute to any new localized CO violations or increase the frequency or severity of any existing violations of CO.
- The project does not delay the timely attainment of the CO standards.

4.6.2.2 Greenhouse Gases and Climate Change

Greenhouse gases are gases that trap heat in the atmosphere. Over time, as human activity has increased, GHG concentrations in the atmosphere have increased as well. Carbon dioxide (CO_2) makes up the largest component of GHG emissions and is the primary GHG emitted by vehicles. Other prominent transportation GHGs include methane and nitrous oxide.

Climate change, GHG emissions, and their associated effects are being addressed through various efforts at federal, state, and local levels. Examples include:

- The National Clean Vehicle Program (UCS, 2010)
- Presidential Executive Order 13514: Federal Leadership in Environmental, Energy and Economic Performance
- Washington State's Climate Change Challenge and supporting legislation
- Washington State's Executive Order 14-04: Washington Carbon Pollution Reduction and Clean Energy Action

- PSRC's *VISION 2040* policies addressing the state's climate change goals (PSRC, 2010b)
- King County's *Strategic Plan 2010-2014* (King County, 2010)
- The Greenhouse Gas Emissions in King County report (King County, 2012)

4.6.3 Affected Environment

4.6.3.1 Regional Climate

The FWLE corridor is located in the Puget Sound lowlands that comprise the lower-elevation lands surrounding the sound. Variations in the temperature, length of the growing season, fog, rainfall, and snowfall are related to such factors as distance from the sound, the rolling terrain, and air from the ocean reaching this area through the Strait of Juan de Fuca. Although this is the most densely populated and industrialized area in the state, there is sufficient wind most of the year to disperse air pollutants released into the atmosphere. Air pollution is usually most noticeable in the late fall and winter season, under conditions of clear skies, light wind, and a sharp temperature inversion. These conditions may prevail a few days before a weather system moves through and removes the air pollution by wind and rain (Washington Region Climate Center, 2013).

4.6.3.2 Pollutants of Concern

Characterizing the existing air quality environment is essential in developing a baseline to assess how changes in vehicle traffic patterns related to the FWLE might affect existing air pollutant concentration levels. Air quality is affected by pollutants that are generated by both natural and human-caused sources. In general, the largest man-made contributors to air emissions are fossil fuel combustion sources such as transportation and industrial operations. The largest contributors of transportation pollution are motor vehicles. Pollutants of concern for this project include the pollutants emitted from motor vehicles, such as CO; particulates; O_3 and its precursors, including nitrogen oxides (NO_x) and volatile organic compounds (VOCs); air toxics; and GHGs.

Carbon Monoxide

In assessing the localized air quality impacts of transportation projects, CO is a pollutant of concern. In urban areas, motor vehicles are the principal sources of CO that cause ambient air quality levels to exceed the NAAQS. CO concentration increases occur during vehicle cold-starts and winter months when meteorological conditions favor the build-up of directly emitted contaminants. CO is a pollutant whose impact is usually localized, with the higher ambient concentrations of CO occurring near congested roadways and intersections.

Carbon monoxide is a colorless, odorless, and tasteless gas that results from the incomplete combustion of fuel. The major source of CO is vehicular traffic, along with industry, wood stoves, and slash burns.

Particulate Matter

Particulate matter is a complex mixture of small particles and liquid droplets that are made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. In the Puget Sound Region, most particle pollution comes from burning in fireplaces and wood stoves in winter. During the summer, vehicle exhaust, land-clearing burning, and backyard burning of yard waste are the predominant sources of fine particles (PSCAA, 2013).

Particulate matter comes in many sizes and shapes and can be made up of hundreds of different chemicals. Some particles, known as primary particles, are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks, or fires. Others form in complicated reactions in the atmosphere of chemicals such as sulfur dioxides and nitrogen oxides that are emitted from power plants, industries, and automobiles. These particles, known as secondary particles, make up most of the fine particle pollution in the U.S.

Ozone

Ozone acts as a protective layer in the stratosphere high above the earth, but it can be harmful to breathe. Ozone is also the primary element of smog. Sunlight and hot weather are the main causes of ground-level ozone formation. As a result, ozone is referred to as a summertime air pollutant. Many urban areas tend to have high levels of ozone, although even rural areas are subject to increased ozone levels due to the wind carrying ozone and because the pollutants that form ozone can be carried miles away from their original sources.

Ground-level ozone is not emitted directly into the air, but is created by chemical reactions between NOx and VOCs in the presence of sunlight. VOC sources can be both naturally occurring and human-generated. Human-generated emissions of VOCs are from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents. These sources are also the main sources of the ozone precursor NOx.

Hazardous Air Pollutants / Air Toxics

In addition to the criteria pollutants, air toxics are another group of pollutants of concern in the region. Of 188 air toxics or hazardous air pollutants regulated by EPA, seven compounds have significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers according to the 1999 National Air Toxics Assessment. This subgroup of seven mobile source air toxics (MSATs) includes benzene, formaldehyde, naphthalene, diesel particulate matter plus diesel exhaust organic gases, acrolein, 1,3-butadiene, and polycyclic organic matter (Federal Highway Administration [FHWA], 2012a). The EPA rule on Control of Hazardous

Air Pollutants from Mobile Sources will decrease MSAT emissions through cleaner fuels and cleaner engines (FHWA, 2012a). Transportation projects with potential for MSAT effects, such as the FWLE, are required to perform project-level MSAT analysis.

At the state and regional level, Ecology and PSCAA list 400 pollutants as air toxics. This list includes the 188 national hazardous air pollutants identified by EPA as well as additional pollutants believed to be harmful. The 2010 PSCAA air toxic study of the Seattle-Tacoma area shows that mobile sources contribute most to health risk from air toxics in the Puget Sound Region (PSCAA, 2010).

Greenhouse Gases

In King County, 48 percent of the GHG emissions are attributable to transportation sources, including motor vehicles, aircraft, construction equipment, and boats (PSCAA, 2012). To reduce GHG emissions from transportation sources, effective planning must incorporate modes of transport that use less energy per person per mile traveled or use energy derived from fuels that have a low carbon content per unit of energy.

Burning fossil fuel to produce electricity is also a source of GHG emissions, although less of a source in King County than in many other regions of the United States, because of the prevalence of hydropower. The updated GHG inventory for King County shows that GHG emissions rose 5 percent from 22.4 million metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2003 to 23.4 million $MTCO_2e$ in 2008, primarily because of population growth (King County, 2012).

4.6.3.3 Existing Air Quality

Criteria Pollutants

The FWLE corridor includes portions of the cities of SeaTac, Des Moines, Kent, and Federal Way in south King County. King County is currently a maintenance area for CO under NAAQS, with the maintenance plan updated and approved by EPA on September 7, 2004 (PSRC, 2010b). The FWLE corridor is designated as attainment or unclassified for all other criteria pollutants (PSRC, 2010b, and EPA, 2012b). Although the project corridor crosses a portion of Kent, the project is not within the boundary of the Kent Valley industrial area where the designation is maintenance for PM_{10} under NAAQS.

PSCAA monitors criteria air pollutant concentrations at several locations in King County, but there is only one active monitoring station that is near the project corridor, located in Kent. The Kent

monitoring station is located at James Street and Central Avenue and measures $PM_{2.5}$ concentrations. The closest active monitoring station for CO, PM_{10}, and O_3 is the Beacon Hill station in Seattle. Monitoring for other criteria pollutants is not performed in King County. Table 4.6-1 displays the last 3 years (2011-2013) of monitoring data at these two stations.

TABLE 4.6-1
Ambient Air Quality Monitoring Data at Kent Station and Beacon Hill Station

Pollutant	NAAQS	2011 Maximum Concentration	2012 Maximum Concentration	2013 Maximum Concentration
Carbon Monoxide (CO)				
1-hour average (ppm)	35	1.0	1.0	1.8
8-hour average (ppm)	9	0.9	0.7	1.4
Ozone				
1-hour average (ppm)	revoked	0.059	0.063	0.051
8-hour average (ppm)	0.075	0.046	0.049	0.047
Particulate Matter (PM_{10})				
24-hour average ($\mu g/m^3$)	150	23.0	28.0	30.0
Particulate Matter ($PM_{2.5}$)				
24-hour average (98th Percentile) ($\mu g/m^3$)	35	25	22	25
Annual arithmetic average ($\mu g/m^3$)	12	7.7	6.5	7.2

Source: EPA, 2012c.
Note: Beacon Hill Station is located at 4103 South Beacon Hill in Seattle, WA. Kent Station is located at 614 N Railroad Avenue in Kent, WA. Concentrations of CO, ozone, and PM_{10} are from the Beacon Hill station. Concentrations of $PM_{2.5}$ are from the Kent station.
ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Concentrations for these pollutants were below the applicable ambient air quality standards at the two stations during 2011 to 2013.

4.6.3.4 Sensitive Receptors

Sensitive air quality receptors typically include land uses where people might be most vulnerable to air pollutant effects on their health, such as residences, schools, daycare centers, nursing homes, and hospitals. The ambient air concentrations presented in Table 4.6-1 are representative of the existing conditions experienced by sensitive receptors located near the FWLE. The land uses in the project vicinity are mixed residential, commercial, and industrial.

4.6.4 Environmental Impacts

This section describes the potential for air quality impacts during operation of the FWLE, discussed first at a regional level and then at the local level. A conformity determination for the project is also

included based on the results of this analysis. Potential air quality impacts during construction are described in Chapter 5, Construction.

4.6.4.1 Regional Direct Impacts

Criteria Pollutant and Air Toxics Emissions

Long-term regional operations impacts were evaluated by calculating tailpipe emissions for all criteria pollutants and toxic air pollutants for existing and future scenarios in the design year of 2035 for all alternatives. Regional traffic distribution from the PSRC Travel Demand Model and traffic volumes from the project's traffic analysis were used to calculate criteria pollutants and toxic air pollutants from tailpipe emissions. An analysis of the 2035 build alternatives' traffic data demonstrates only minor differences in travel patterns, traffic volumes, delay times, and roadway speeds when compared to the No Build Alternative.

Long-term regional emission rates for criteria pollutants and toxic air pollutants for existing conditions and for future design year 2035 No Build and build alternatives were calculated utilizing EPA's Motor Vehicle Emission Simulator (MOVES) model version 2010b, which estimates change based on reduction in VMT. Tailpipe emissions for existing conditions (2014) were compared to the 2035 No Build Alternative to illustrate the future trend in pollutant emissions for the Puget Sound regional airshed.

Table 4.6-2 summarizes tailpipe emissions for criteria pollutants for the existing and FWLE build alternatives.

TABLE 4.6-2
Daily Regional Emission Burden Assessment for Design Year 2035

Criteria Pollutant	Existing 2014	2035 No Build Alternative	2035 Build Alternative	Percent Change from Existing (2014) to No Build Alternative (2035)	Percent Change from No Build to Build Alternative (2035)
VMT	87,624,020	103,863,480	103,709,090	18.53%	-0.15%
CO (lb/day)	58,304	32,711	32,657	-43.90%	-0.17%
$PM_{2.5}$ (lb/day)	471	177	177	-62.42%	0%
PM_{10} (lb/day)	500	192	192	-61.60%	0%
VOCs (lb/day)	1,711	197	197	-88.49%	0%
NO_x (lb/day)	8,638	2,031	2,027	-76.49%	-0.20%

Sources for 2014 conditions: PSRC Travel Demand Model and EPA MOVES model 2010b.
lb/day = pounds per day

No Build Alternative

As shown in Table 4.6-2, under the 2035 no build conditions, VMT is expected to increase over existing conditions by 18.53 percent. However, pollutant emissions for all criteria pollutants would be lower than existing levels due to the assumption of a newer and cleaner automobile fleet in 2035.

Build Alternatives

The build alternatives would have a slightly smaller increases in VMT than the No Build Alternative in 2035. All criteria pollutants under the build alternatives would be well below existing conditions pollutant levels.

Mobile Source Air Toxic Emissions

Regional impacts of MSATs are evaluated in accordance with FHWA's *Interim Guidance on Air Toxic Analysis in NEPA* [National Environmental Policy Act] *Documents* (FHWA, 2012b). Currently, there are no established criteria for determining when MSAT emissions should be considered a problem; however, FHWA's Interim Guidance provides an approved approach to evaluating potential MSAT effects.

EPA has developed several emission control programs for vehicle engines and fuels that will reduce MSATs over the next 20 years. According to a study conducted by FHWA (FHWA, 2012b) utilizing the MOVES model, even if VMT increases by 102 percent, implementing approved control programs will decrease MSAT emission rates by 83 percent from 1999 to 2050.

MSAT Reduction Programs

These programs include reformulated gasoline, a product of CAA legislation targeting the nation's more acute O_3 nonattainment areas; National Low Emissions Vehicle standards; Tier 2 motor vehicle emission standards and associated gasoline sulfur control requirements; heavy-duty engine standards and on-highway diesel sulfur control requirements; the final rule for non-road diesel engines; and proposals for marine and locomotive engines and the 2001 MSAT rule toxic emissions performance standard.

No Build Alternative

Table 4.6-3 summarizes the existing and projected tailpipe emissions for toxic air pollutants in the project corridor. Under the No Build Alternative, VMT is expected to increase over existing conditions, however MSAT emissions would decrease due to EPA's national control programs.

TABLE 4.6-3
Mobile Source Air Toxic Emissions for Design Year 2035

MSAT	Existing 2014	2035 No Build Alternative	2035 Build Alternatives	Percent Change from Existing (2014) to No Build Alternative (2035)	Percent Change from No Build to Build Alternative (2035)
VMT	87,624,020	103,863,480	103,709,090	18.53%	-0.15%
1-3-Butadiene (lb/day)	43.05	5.32	5.31	-87.65%	-0.15%
Acrolein (lb/day)	12.33	2.83	2.83	-77.06%	-0.06%
Benzene (lb/day)	322.87	40.64	40.58	-87.41%	-0.15%
Formaldehyde (lb/day)	190.24	56.49	56.46	-70.31%	-0.06%
Diesel PM (lb/day)	2,078.83	997.83	996.45	-52.00%	-0.14%
Naphthalene (lb/day)	30.98	6.11	6.10	-80.28%	-0.09%
Polycyclic organic matter (lb/day)	51.12	10.71	10.30	-79.05%	-3.84%

Sources for 2014 conditions: PSRC Travel Demand Model and EPA MOVES model 2010b.
lb/day = pounds per day

Build Alternatives

For the build alternatives, MSAT emissions within the project corridor are expected to be lower than existing levels due to continued improvements resulting from EPA's national control programs; they would also be lower than the No Build Alternative due to lower VMT. As a result, the FWLE would generate minimal air quality impacts for CAA criteria pollutants and would not be linked with any special MSAT concerns. Consequently, MSATs impacts are not expected to occur as a result of the FWLE.

Greenhouse Gases

Vehicle Emissions

The analysis of GHG emission impacts included evaluating the vehicle movements occurring within King County. MOVES was used to estimate GHG emissions, typically presented as the total CO_2 equivalent (CO_{2e}) released, for the existing and future design year 2035 No Build and build alternatives. As shown in Table 4.6-4, CO_{2e} emissions from vehicle movement are estimated to decrease by 2,038 metric tons annually in the region with the project due to the slight decrease in VMT, an 0.11 percent reduction compared to the No Build Alternative.

Sound Transit's Sustainability Plan

In June 2011, Sound Transit released a *Sustainability Plan* that gives an overview of the agency's efforts in reducing energy use, greenhouse gases, and air pollution throughout the region. The *Sustainability Plan* is organized around the principles of People, Planet and Prosperity. With these principles in mind, Sound Transit has developed nine sustainability priorities to guide their long-term achievements. These priorities focus on expanding transit services and ridership, improving stations and facilities, and deploying the most fuel-efficient, clean, and cost-effective vehicles. Successfully focusing on these priorities will reduce VMT within the region. Implementation of this *Sustainability Plan* during the operation of the FWLE will reduce VMT and GHG emissions within the region.

TABLE 4.6-4
VMT Greenhouse Gas Emissions in Terms of CO_{2e} for Design Year 2035

Emission	2035 No Build Alternative	2035 Build Alternative
Daily CO_{2e} (lb/day)	29,928	29,894
Daily CO_{2e} reduction (lb/day)	Not Applicable	34
Annual CO_{2e} reduction (lb/day)	Not Applicable	12,410
Annual CO_{2e} reduction (metric tons/year)	Not Applicable	2,038

Sources for 2014 conditions: PSRC Travel Demand Model and EPA MOVES model 2010b.
lb/day = pounds per day

Energy Emissions

According to the energy analysis performed for this project, operation of the light rail system would produce a demand on the local electrical provider, Puget Sound Energy. Assuming that the light rail system would operate 365 days per year, the annual megawatt hours (MWh) consumed by the build alternatives would be about 4,800 MWh. The energy demand from the operation of the build alternatives would result in GHG emissions of 5,720 metric tons of CO_2e per year.

The energy required for the build alternatives would be delivered by PSE. In 2012, the PSE energy source mix was 42 percent generated by hydroelectric plants, which produce essentially no GHG emissions (PSE, 2012). Based on these current fuel mix conditions, not all of the energy required by the build alternatives would generate GHG emissions and would lower the total GHG emissions described above to 3,318 metric tons of CO_2e per year. Changes in PSE's energy source mix in the future could increase or decrease this amount.

While there would be a reduction in emissions from reduced VMT as shown in Table 4.6-4, there would be an increase in emissions from energy generation to operate the light rail system. When emissions from VMT and energy generation for operations are combined, there would be a net increase of 1,280 metric tons of CO_2e per year when compared to the No Build Alternative. This is equivalent to the average energy consumed by 176 households (EPA Equivalency, U.S. Energy Information Administration, 2009; EPA, 2014a). These GHG emissions would be less than 0.000133 percent of the statewide 2011 inventory and less than 0.000002 percent of the 2012 national GHG

inventory (Washington State Department of Ecology, 2012; EPA, 2014b).

4.6.4.2 Local Direct Impacts

The FWLE build alternatives would not substantially change the volumes of vehicular traffic in the project vicinity, and minimal air pollutant emissions would occur during operation because light rail trains are electrically powered. In addition, light rail is anticipated to improve air quality by shifting commuters from motor vehicles to light rail transit. As presented in Table 4-6.1, data collected from CO monitoring sites in the project vicinity demonstrate that the area has not exceeded the CO NAAQS in the last 3 years. However, air quality in the project vicinity could be affected by changes in traffic flow and volumes locally and regionally and as a result of increased vehicular traffic near the light rail stations. Further, the project must meet air quality conformity standards for a CO maintenance area.

EPA has developed guidance to evaluate concentrations near roadway intersections where motor vehicle emissions can be high due to increased congestion and idling at traffic signals. Procedures and guidance used for this analysis to conduct a CO hot-spot analysis are consistent with 40 CFR 93. 123 (a) and 40 CFR Part 51, Appendix W (Guideline on Air Quality Models).

To evaluate whether the project would cause potential CO hot spots, the EPA's CAL3QHC modeling tool was used to analyze the CO levels of the impacted intersections in the project vicinity. In addition, EPA's MOVES was used to calculate CO emission rates needed as an input in the CAL3QHC model.

Traffic data were used to identify the three worst intersections (in terms of level of service) operating within the project corridor. These intersections are:

- Kent-Des Moines Road and SR 99
- Kent-Des Moines Road and I-5 southbound ramps
- Kent-Des Moines Road and Military Road S

CO emissions were modeled at each of the three intersections for existing and design year 2035 No Build and build alternative conditions. Modeling results of the 1-hour and 8-hour CO concentrations are presented in Table 4.6-5.

TABLE 4.6-5
Modeled CO Concentrations

Intersection	2014 Existing		2035 No Build		2035 Build	
	1- Hour	8-Hour	1- Hour	8-Hour	1- Hour	8-Hour
Kent-Des Moines Road and SR 99 (ppm)	2.4	1.7	2.2	1.5	2.2	1.5
Kent-Des Moines Road and I-5 Southbound Ramps (ppm)	2.3	1.6	2.2	1.5	2.2	1.5
Kent-Des Moines Road and Military Road S (ppm)	2.4	1.7	2.3	1.6	1.9	1.3

Note: Background concentration is 1.8 ppm. The 1-hour and 8-hour NAAQS for CO are 35 ppm and 9 ppm, respectively.

A summary of the modeling results is shown in Table D4.6-3 in Appendix D4.6. The specified receptor CO concentrations are less than the 1-hour and 8-hour NAAQS of 35 ppm and 9 ppm, respectively, and the intersections do not require further CO hot-spot dispersion modeling; therefore, they pass the complete CO hot-spot modeling analysis. CO concentrations are not expected to exceed the NAAQS, and no additional modeling is required.

4.6.4.3 Conformity Determination

Under the build alternatives, modeled CO concentrations for the top three worst-case intersections were similar for future design year 2035 No Build and build alternatives because of the continued reductions from the implementation of control measures for mobile sources. Regardless of the FWLE build alternative chosen, CO concentrations would not exceed the NAAQS. The project is included in the region's MTP (*Transportation 2040*, PSRC, 2010a), in the *2040 Transportation Plan Update* (PSRC, 2014a), and in the *2013-2016 Regional Transportation Improvement Program* (PSRC, 2012). The FWLE is in both the MTP and RTIP, which meets regional conformity, as demonstrated in the Transportation 2040 Update Appendix E: Regional Air Quality Conformity Analysis (PSRC, 2014b). Therefore, the FWLE has met the CAA transportation conformity requirement of being included in the financially constrained and conforming regional plans, which have been found to conform to the SIP.

As shown in Table D4.6-3, intersections in the project vicinity currently do not exceed the CO NAAQS and the FWLE would not create any new exceedances. Therefore, the project meets conformity requirements for CO. Operation of the FWLE is expected

to provide an air quality benefit to the surrounding area due to the shift of bus ridership to light rail ridership.

4.6.4.4 Indirect Impacts

The traffic analysis prepared for the FWLE evaluated the long-term VMT generated by the project. As shown in Table 4.6-2, the comparison of VMT for 2035 for No Build and build alternatives indicates that an indirect air quality benefit would occur because the project would decrease traffic and reduce congestion. Improvements such as these in the project corridor would help decrease air pollutant and GHG emissions throughout the region. The use of energy to operate the light rail would indirectly add GHG emissions outside the project corridor related to energy production.

4.6.5 Potential Mitigation Measures

The air pollutant and GHG emissions analysis demonstrated that no impacts are expected to occur during the operation of the project; therefore, no mitigation measures during project operation would be necessary.

4.7 Noise and Vibration

4.7.1 Summary

The noise and vibration analysis was performed for over 5,000 noise- and vibration-sensitive properties along the SR 99 corridor and approximately 3,100 properties along the I-5 corridor. Generally there would be greater impacts for alternatives along SR 99 because there are sensitive receivers along both sides of the entire alignment, including nearby multi-family residences and motels with large numbers of units. The Kent/Des Moines HC Campus Station Option from the potential additional station at S 216th Street (West option) and the S 272nd Redondo Trench Station Option would substantially reduce the impacts from the SR 99 Alternative. The lowest number of noise impacts occurs with the I-5 Alternative with the Federal Way S 320th Park-and-Ride Station Option. Table 4.7-1 summarizes the number of noise impacts by alternative before and after mitigation. All impacts could be mitigated using a combination of sound walls and sound insulation where necessary.

TABLE 4.7-1
Summary of Noise and Vibration Impacts

Alternative	Noise Impacts (Range with Options)[a]		Vibration Impacts (Range with Options)		Groundborne Noise Impacts	
	Before Mitigation	After Mitigation	Before Mitigation	After Mitigation	Before Mitigation	After Mitigation
SR 99	**3,726** (2,015-3,786)	**0**	**50** (0-271)	**0**	**1**	**0**
I-5	**1,450** (1,330-1,646)	**0**	**222** (202-225)	**0**	**0**	**0**
SR 99 to I-5	**2,190** (1,793-2,210)	**0**	**209** (209-227)	**0**	**0**	**0**
I-5 to SR 99	**2,942** (2,340-2,986)	**0**	**45** (45-238)	**0**	**1**	**0**

[a] Moderate and severe impacts combined.

Under the SR 99 Alternative, the only vibration impact would occur at a hotel in the northern section of the corridor. The S 216th West Station Option would avoid impacting this hotel, resulting in no vibration impacts for this alternative. The SR 99 Alternative would have up to 271 vibration impacts when combined with other station options. The I-5 Alternative would have 222 potential vibration impacts, with impacts at single- and multi-family buildings, along with two hotels. There would be a groundborne noise impact at the

Federal Way High School Performing Arts Center (currently under construction) with the SR 99 and I-5 to SR 99 alternatives. Table 4.7-1 summarizes the projected noise and vibration impacts before and after potential mitigation measures. Using standard vibration-reducing methods, all vibration impacts could be mitigated.

Potential mitigation measures for noise impacts could include sound walls (barriers on the light rail guideway and/or freestanding walls), installing special track work to reduce noise levels at crossovers, and insulating residential buildings where necessary. Mitigation for vibration impacts could include resilient fasteners, ballast mats, and special track work.

4.7.2 Introduction to Resource and Regulatory Requirements

This section discusses the fundamentals of noise and vibration analysis, and the regulatory setting governing train noise and vibration for federally funded projects. For more detailed information see Appendix G3, Noise and Vibration Technical Report.

4.7.2.1 Fundamentals of Noise and Vibration Analysis

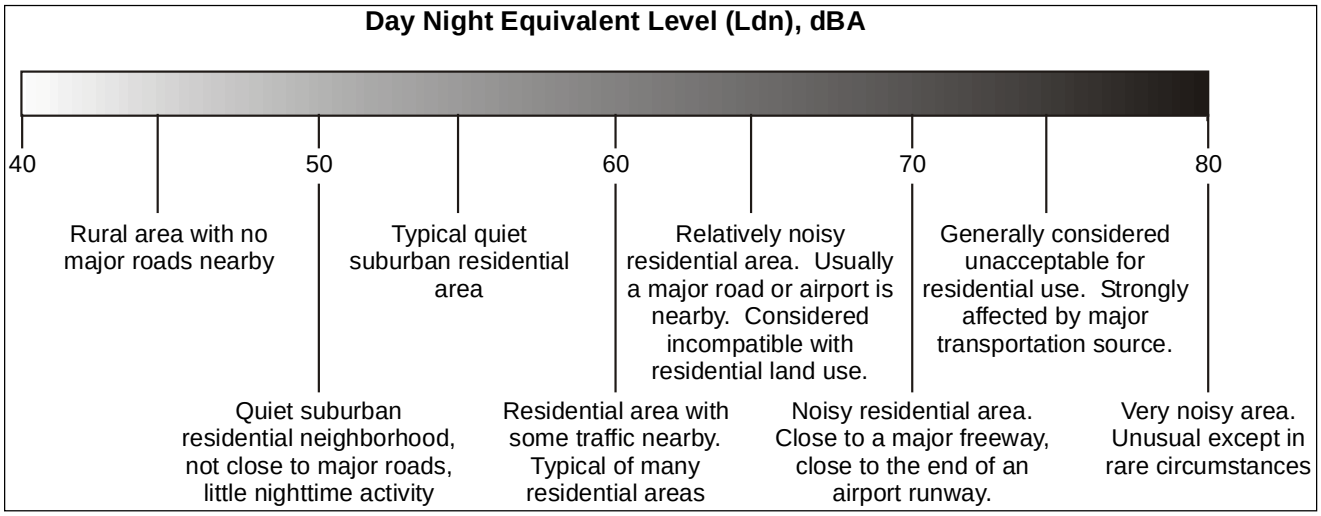
Noise

Noise is defined as unwanted sound; it is measured in terms of sound pressure level and is usually expressed in decibels (dB), a conversion of the air pressure to a unit of measurement that represents the way humans hear sounds. The human ear is less sensitive to higher and lower frequencies than it is to midrange frequencies. To provide a measurement meaningful to humans, a weighting system was developed that reduces the sound level of higher and lower frequency sounds, similar to what the human ear does. This filtering system is used in virtually all noise ordinances. Measurements taken with this "A-weighted" filter are referred to as A-weighted decibel (dBA) readings.

Two primary noise measurement descriptors are used to assess noise impacts from traffic and transit projects, the equivalent sound level (Leq) and the day-night sound level (Ldn), defined below:

- **Leq:** The Leq is the level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. The peak-hour Leq is used for all traffic noise analyses and for light rail noise analyses at locations with daytime use, such as schools and libraries.

- **Ldn:** The Ldn is an Leq over a 24-hour period, with 10 dBA added to nighttime sound levels (between 10 p.m. and 7 a.m.) as a penalty to account for the greater sensitivity and lower background sound levels during this time. The Ldn is the primary noise level descriptor for light rail noise at residential land uses. Exhibit 4.7-1 graphs typical Ldn noise levels and residential land use compatibility.



Source: Federal Transit Administration, 2006.

EXHIBIT 4.7-1
Typical 24-hour Ldn Noise Levels and Land Use Compatibility

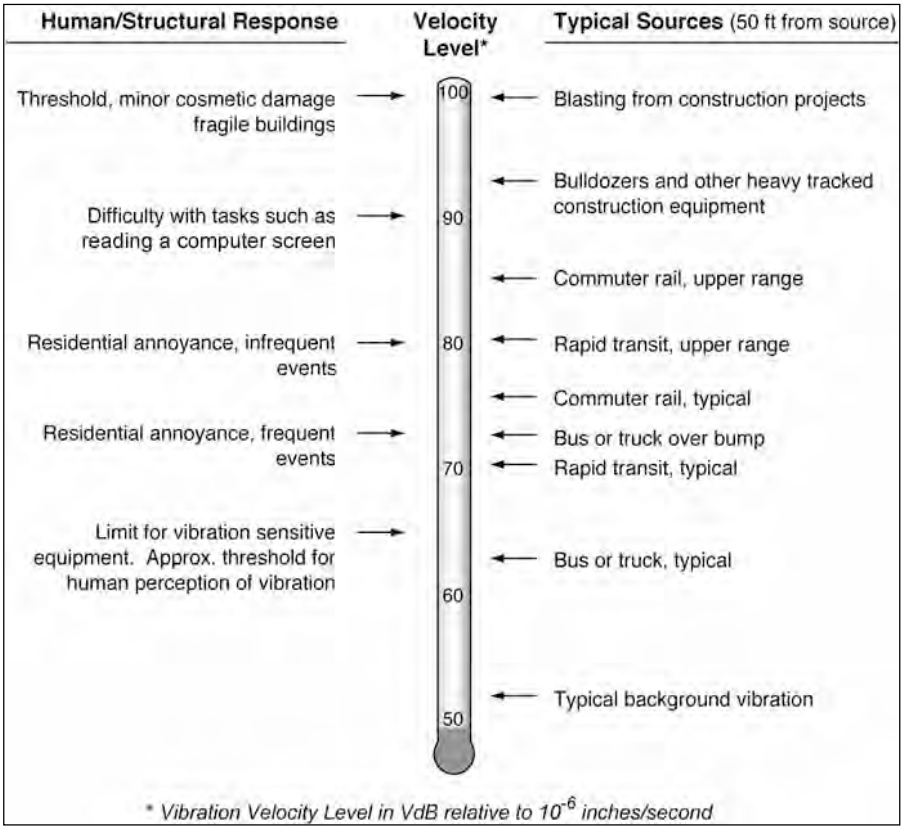
Vibration

Groundborne vibration generated from train operations on the FWLE would be transmitted from the tracks through the soil. Vibration above certain levels can disrupt sensitive operations, and cause annoyance to humans within buildings. Transit systems rarely produce vibration with sufficient magnitude to cause any structural damage. Vibration can be measured in terms of displacement, velocity, or acceleration. The response of humans, buildings, and equipment to vibration is most accurately described using velocity or acceleration. Velocity is the preferred measure for evaluating vibration from transit projects because it is typically considered to correspond best with human sensitivity. Vibration is expressed in terms of the root-mean-square vibration velocity level in decibels (VdB). The abbreviation VdB is used in place of dB to avoid confusing vibration decibels with sound decibels.

The vibration of a building could result in generation of noise inside indoor spaces from the movement of room surfaces such as walls.

This is called groundborne noise and can be experienced as a perceptible rumble. Groundborne noise levels are expressed in A-weighted decibels (dBA).

Exhibit 4.7-2 illustrates typical vibration velocity levels for common sources, as well as thresholds for human and structural response to groundborne vibration. As shown, the range of interest is from approximately 50 VdB to 100 VdB (i.e., from imperceptible background vibration to the threshold of damage). The approximate threshold of human perception to vibration is 65 VdB. Humans generally do not find vibration from light rail operations annoying until the vibration exceeds 70 to 75 VdB.



Source: Federal Transit Administration, 2006.

EXHIBIT 4.7-2
Examples of Groundborne Vibration Levels and Human/Structural Response

4.7.2.2 Noise and Vibration Impact Criteria

The following sections provide an overview of the criteria used for evaluating FWLE noise and vibration impacts, which are defined by the Federal Transit Administration (FTA) for transit-related noise and vibration and by the Federal Highway Administration (FHWA) for traffic-related noise. Because this project includes funding from FTA,

the FTA methods are the governing methods for the noise and vibration analysis. The FTA noise and vibration analyses are performed based on actual land uses, not zoning designations. Therefore, under FTA methods, if a residence is located in an area zoned commercial, that property is analyzed as a residential land use with nighttime sensitivity to noise.

The potential for increased exposure to traffic noise was also evaluated for noise-sensitive land uses. This could result from the development of new or extended roadways in station areas, or from the removal of buildings, walls, or berms that currently provide shielding from traffic noise.

Finally, FWLE would operate in the cities of SeaTac, Des Moines, Kent, and Federal Way, all of which are in King County. Hence, several different local noise ordinances would be applicable to the operation of ancillary facilities, such as park-and-ride lots, and traction-power substations, along with project-related construction activities. Local noise ordinances are discussed further in Appendix G3, Noise and Vibration Technical Report.

Transit Noise Criteria

The analysis of potential noise impacts from the FWLE alternatives is based on the criteria defined in the FTA guidance manual Transit Noise and Vibration Impact Assessment (FTA, 2006). The FTA noise impact criteria are founded on well-documented research of community reaction to noise and are based on changes in existing noise levels because of the transit project. The Ldn is used to characterize noise exposure for residential areas or places where people sleep, such as hotels and hospitals (Category 2). For other noise-sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum 1-hour Leq during the facility's operating period is used. Two levels of impacts are included in the FTA criteria: moderate, and severe. These are described in more detail in Appendix G3.

FTA Impact Categories

FTA's noise impact criteria are grouped into the following noise-sensitive land use categories:

- Category 1: Buildings or parks where quiet is an essential element of their purpose
- Category 2: Residences and buildings where people normally sleep, including residences, hospitals, and hotels where nighttime sensitivity is assumed to be important
- Category 3: Institutional land uses with primarily daytime and evening use, including schools, libraries, churches, and some parks

Parks are considered a special case under the FTA criteria. Whether a park is considered noise-sensitive is dependent on the typical uses in the park. Parks that are primarily used for recreational activities or sporting events, such as football, baseball, soccer, and other active sports and recreation, are not considered noise-sensitive. Parks that are primarily used for passive

activities, such as reading, conversation, and meditation, could be considered noise-sensitive, but only those parks with low existing noise levels.

Parks along the FWLE corridor were reviewed for their use, existing noise levels, and proximity to major noise sources, such as highways and major arterial roadways. Each of these factors was considered when evaluating parks and making the determination of the noise sensitivity of each park.

Transit Vibration Criteria

The FTA's groundborne vibration impact criteria are based on existing land use and anticipated train frequencies. Unlike noise, the FTA vibration thresholds do not specifically account for existing vibration because it is rare that even substantial volumes of vehicular traffic, including trucks and buses, generate perceptible ground vibration unless there are irregularities in the roadway surface, such as potholes or wide expansion joints. The FTA vibration criteria are applied primarily to residential (including hotels and other places where people sleep) and institutional land uses. Commercial land uses are only considered when they contain vibration-sensitive uses, such as medical offices or sensitive manufacturing equipment. The criterion applied to these locations is dependent on the sensitivity of the use. The impact criteria are for the maximum indoor train vibration level at the sensitive receivers as a train passes. Table 4.7-2 shows the FTA vibration criteria used in this analysis. More detail on these criteria is provided in Appendix G3. Mitigation will be evaluated for all vibration impacts.

Some buildings, such as concert halls, recording studios, and theaters, can be very sensitive to vibration but do not easily fit into any of the three categories listed in Table 4.7-2. FTA categorizes them as "Special Buildings" and provides separate criteria for groundborne noise and vibration. The only building in the FWLE corridor that qualifies as a special building would be the Federal Way High School Performing Arts Center, currently under construction along the west side of SR 99 near S 308th Street. Impacts on this building were evaluated based on construction drawings provided by Federal Way Public Schools.

TABLE 4.7-2
FTA Groundborne Vibration and Noise Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB with reference to 1 micro inch/sec)	Groundborne Noise Impact Levels (dB with reference to 20 micro Pascals)
Category 1: Buildings where low ambient vibration is essential for interior operations	65 VdB[a]	N/A[b]
Category 2: Residences and buildings where people normally sleep	72 VdB	35 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	40 dBA
Special Buildings-Auditorium	65 VdB	25 dBA

Source: FTA, 2006.

[a] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes.
[b] Vibration-sensitive equipment is generally not sensitive to groundborne noise.

The Federal Way Performing Arts and Conference Center is currently being designed and reviewed by the City of Federal Way. When built, this facility would be located along S 316th Street north of the Federal Way Transit Center. The proposed auditorium would also be considered a special building. Because the design of the facility is not yet determined, potential groundborne noise and vibration effects at this location are discussed qualitatively in Chapter 6, Cumulative Impacts. Impact criteria for this type of building are provided in Table 4.7-2. Also, outdoor spaces such as parks are not considered vibration-sensitive by the FTA.

For transit systems that are at-grade or on an elevated guideway, groundborne noise is not applied to any of the three FTA categories listed in Table 4.7-2. Noise from alternatives in trenches can cause groundborne noise, but it would only be noticeable in areas with low existing noise levels (e.g., below 50 dBA). Due to higher existing noise levels in the FWLE corridor, groundborne noise is not expected to be an issue with the FWLE.

Traffic Noise Criteria

FTA directs projects to use FHWA traffic noise assessment and mitigation processes on certain kinds of joint FTA and FHWA projects. Because the FWLE is not a joint project, FTA criteria apply.

Where a transit project could change traffic noise levels experienced by sensitive receivers (for instance, because it would relocate existing highway sound walls or remove existing structures that screen highway noise), FTA requires analysis of both transit noise impacts,

using the FTA criteria, and traffic noise impacts, using the FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise, *Code of Federal Regulations* (CFR) Title 23, Subchapter H, Section 772 (1982).

A traffic noise impact occurs if predicted traffic noise levels approach the criteria levels for specific land use categories or substantially exceed existing noise levels (e.g., a 10 dB increase). These levels are defined as noise abatement criteria (NAC), and are based on hourly Leq levels for the peak hour of traffic noise. The land use of greatest concern in the FWLE corridor would be Type B, which includes residences, motels, hotels, playgrounds, active sports areas, parks, schools, churches, libraries, and hospitals. The NAC used to determine impacts on this land use is 67 dBA. Based on the *2011 Traffic Noise Policy and Procedures* (Washington State Department of Transportation [WSDOT], 2012), a traffic noise impact occurs if predicted noise levels are within 1 dB of the NAC. Therefore, an impact to Type B land uses would occur at 66 dBA.

Washington State and Local Noise Criteria

The cities of SeaTac, Des Moines, Kent, and Federal Way have their own local noise ordinances that would be applicable to the FWLE. In the absence of a local noise ordinance, the State of Washington defines maximum environmental noise levels (WAC 173-60). State regulations make clear that the function of noise abatement and control is left to local government (WAC 173-60-110). Therefore, the various local noise ordinances would be applicable to the operation of FWLE light rail stations/park-and-rides, and to project construction.

For stationary land uses with noises originating from outside public roadways and rights-of-way, all of the local ordinances use three classes of property use, called Environmental Designation for Noise Abatement (EDNA). The maximum allowable noise levels for each EDNA are shown in Table 4.7-3. For example, the noise caused by a commercial property must be less than 57 dBA at the closest residential property line. Between 10 p.m. and 7 a.m., the maximum allowable levels shown in Table 4.7-3 are reduced by a 10-dBA "penalty" at such a residential property line.

Construction noise is discussed in Chapter 5, Construction. More detailed information on the applicable noise regulations for each city is provided in Appendix G3.

TABLE 4.7-3
Local Noise Limits

Property Usage	Maximum Allowable Sound Level (dBA)		
	Residential	Commercial	Industrial
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

Source: WAC Chapter 173-60-040. Also used by: SeaTac Municipal Code, Chapter 8.05.360; City of Des Moines Municipal Code section 7.16.010; City of Kent Municipal Code Chapter 8.05; and City of Federal Way Code Section 7.10.050.

4.7.3 Affected Environment

This section summarizes existing land uses along the FWLE corridor, as well as existing noise and vibration levels as measured for the FWLE analysis. There are no noise-sensitive parks in the FWLE corridor.

4.7.3.1 Noise- and Vibration-Sensitive Land Uses

A summary of noise- and vibration-sensitive land uses by FWLE alternative and option is provided below. Station or alignment options with different land uses than the FWLE alternatives are noted below.

SR 99 Alternative

Along SR 99, most of the land use is commercial, with some multi-family residences, schools, and a library. In most places, the single-family residential neighborhoods in the SR 99 corridor are not located immediately on or adjacent to SR 99.

Kent/Des Moines HC Campus Station Option

The distinguishing land use feature of the Kent/Des Moines HC Campus Station Option is the proximity of single- and multi-family residential neighborhoods to the alignment.

S 272nd Redondo Trench Station Option

South of S 288th Street and south of the Sacajawea Middle School, there are more single-family uses adjacent to this alignment than the SR 99 Alternative.

I-5 Alternative

There is a concentration of multi-family residences north of Kent-Des Moines Road and many single-family residential neighborhoods located adjacent to the west side of the I-5 Alternative. There are commercial, hospitality, and school uses as well, but fewer than the SR 99 Alternative. The majority of the east side of the alignment is I-5.

Landfill Median Alignment Option

Along this alignment option, land use on the east side of I-5 is almost entirely single-family residences.

SR 99 to I-5 Alternative

Land uses along the SR 99 to I-5 Alternative are the same as described under the SR 99 Alternative north of the Kent/Des Moines Station and the same as the I-5 Alternative south of the Kent/Des Moines Station.

I-5 to SR 99 Alternative

Land uses along the I-5 to SR 99 Alternative are the same as described under the I-5 Alternative north of the Kent/Des Moines Station and the same as the SR 99 Alternative south of the Kent/Des Moines Station.

4.7.3.2 Noise Measurements

Long-term noise monitoring locations were measured for 24 to 36 hours, while short-term monitoring locations were measured for 15 minutes. Noise levels in the project corridor are dominated by transportation-related noise sources. For the SR 99 corridor, noise is dominated by traffic along SR 99 and the other major arterials and cross streets, such as Kent-Des Moines Road, S 272nd Street, and S 320th Street. Other noise sources in the corridor include aircraft from Seattle-Tacoma International Airport (Sea-Tac Airport) and miscellaneous industrial activities, commercial activities, and local construction projects. The Ldn noise levels along the SR 99 corridor generally ranged from 61 to 69 dBA, with a few locations above and below this range.

In the I-5 corridor, noise is dominated by I-5 traffic. As with the SR 99 corridor, major and minor arterial roadways and ramps to and from the highway also contribute to the overall noise in this corridor. Lesser contributors to the noise environment include aircraft to and from Sea-Tac Airport, and construction activities. The Ldn noise levels along the I-5 corridor generally ranged from 63 to 72 dBA, with a few locations above and below this range.

A table summarizing existing conditions and maps of all monitoring locations are provided in Appendix G3.

4.7.3.3 Vibration Testing and Measurements

Vibration propagation tests were performed at 12 sites in the FWLE corridor, with 4 sites located along SR 99, 5 sites located along I-5, and 2 sites located along 30th Avenue. The data from the propagation testing were used in the vibration analysis. Appendix G3 contains a

table summarizing existing conditions, as well as maps of these testing locations.

4.7.4 Environmental Impacts

This section summarizes the models used to predict future noise and vibration levels and identifies where levels are predicted to exceed impact criteria at specific locations. These sources include light rail operation, changes in traffic due to the FWLE, and construction activities. Additional information on the technical assessment of impacts is provided in Appendix G3.

4.7.4.1 Methodology and Assumptions for Noise and Vibration Analysis

The light rail noise and vibration analysis was performed in accordance with FTA's 2006 guidance manual. The noise and vibration analysis that follows was performed using the conceptual FWLE design and follows the detailed analysis methods described in the FTA guidance manual.

Input to the model for the prediction of noise from train operations includes train headways, speeds, and measured reference noise levels of the existing fleet of Sound Transit light rail vehicles. Noise measurements of actual train operations on Central Link were used and allow more accurate noise modeling for future light rail conditions of other Sound Transit projects. Also included in the modeling were the elevations of properties, shielding and topographical features, and information on the track type. Noise levels associated with train-mounted warning bells were modeled in accordance with Sound Transit policy for audible warning devices. No at-grade road crossings would occur with any of the FWLE alternatives; therefore, there would be no potential for noise impacts from warning bells at such crossings. The model does not assume wheel squeal because under Sound Transit's light rail design criteria, any curves with a radius of less than 1,250 feet near noise-sensitive properties must be built to allow for subsequent lubrication. This lets Sound Transit add lubricators if wheel squeal occurs during system operation. The FTA noise assessment methodology was also applied to the park-and-rides and transit centers as stationary transit facilities.

The potential to create or increase exposure to traffic noise because of the transit project was evaluated qualitatively. As defined in FHWA noise abatement policy (FHWA, 2011), changes in the traffic noise

environment could occur if the project creates new or alters existing roadways in relation to noise-sensitive properties, or changes the pathway for traffic noise by removing or altering barriers (buildings, berms, or walls) that currently provide some level of shielding from traffic noise. These locations were identified and evaluated for potential traffic noise impacts based on existing noise measurements and FHWA impact criteria.

The prediction of groundborne vibration from train operations for the FWLE alternatives used measured vibration levels from Sound Transit's Central Link corridor and vibration propagation tests performed along the FWLE alternatives.

4.7.4.2 No Build Alternative

With the No Build Alternative, noise levels in the project corridor would continue to be dominated by other transportation-related noise sources, including cars, trucks, and aircraft from Sea-Tac Airport. Other noise sources could include miscellaneous industrial activities, commercial activities, and local construction projects. With the No Build Alternative, there would be no light rail project, and therefore no light rail-related noise or vibration.

4.7.4.3 Noise Impacts from Build Alternatives

This section provides a summary of the number of predicted noise impacts from each of the FWLE alternatives from light rail operations without mitigation. Along the SR 99 corridor, there were over 5,000 units evaluated for noise impacts, and along I-5, there were approximately 3,100 units evaluated for noise impacts. The actual number of units may vary slightly based on alternative and station options because of the many multi-family buildings and hotels along the corridors. Table 4.7-4 summarizes the projected noise impacts by alternative, the range of impacts with station and alignment options, and proposed mitigation. The low and high ends of the impact range can reflect a combination of options to capture the minimum and maximum potential impacts. Most impacts could be mitigated with sound walls, but some impacts are expected to require residential sound insulation as well where walls cannot be built tall enough to fully mitigate impacts. The number of units that are expected to require insulation is provided in parentheses in the mitigation column of Table 4.7-4. Details on projected impacts for each individual station and alignment option are included in Appendix G3 and described further in this section.

TABLE 4.7-4
Summary of Projected Noise Impacts from Light Rail Operations

Alternative	Light Rail Noise Impacts (Range with Options)[a]	Potential Mitigation[b]
SR 99 Alternative	**3,726** (1,738-3,786)	Sound walls and insulation where necessary (79 to 228)
I-5 Alternative	**1,450** (1,330-1,646)	Sound walls and insulation where necessary (1)
SR 99 to I-5 Alternative	**2,190** (1,793-2,210)	Sound walls and insulation where necessary (25)
I-5 to SR 99 Alternative	**2,942** (2,273-2,986)	Sound walls and insulation where necessary (79 to 228)

[a] Moderate and severe impacts combined.
[b] Numbers in parentheses indicate the number of units where residential insulation would be necessary because sound walls may not fully mitigate impacts.

SR 99 Alternative

There would be 3,726 noise impacts with the SR 99 Alternative. The impacts would be distributed throughout the length of the alternative, and many of the properties where impacts would occur are multi-family complexes or motels, which contributes to the high number of impacts.

There would be a noise impact at the easternmost part of the Federal Way High School, with operational noise levels just meeting the FTA impact criteria. In addition, exterior noise levels at the new Federal Way High School Performing Arts Center would result in an impact. It is important to note that the noise impact predicted for Federal Way High School is an exterior noise impact. The typical mitigation measures used by Sound Transit are to first mitigate at the source, which would include installing sound walls between the light rail and the school. As a new building under construction adjacent to SR 99, the building may have sufficient exterior to interior noise reduction. Based on a review of the building design, the interior noise levels at all noise-sensitive parts of the school are estimated to be 35 to 45 dB (or more) lower than the exterior noise levels, and therefore no interior noise impacts are expected. If this alternative is advanced, additional acoustical testing may be performed when construction is complete to determine the exterior-to-interior noise reduction and verify that noise levels in classrooms, the performing arts area, and other noise-sensitive parts of the building are within the applicable standards.

Other Category 3 land uses (including schools, libraries, and churches) with noise impacts along the SR 99 corridor include the Citadel

Church, the Open Door Baptist Church, the Seattle Full Gospel Church, the Woodmont Library, the Rissho Kosei Kai of Seattle Buddhist Learning Center, Church of Christ West Campus, the Jesus Christ Salt and Light Church, and the Smart Start Day Care.

For all options discussed below that are located on the side of SR 99, noise impacts would generally be greater on the side of the road the alignment would be located on, while impacts on the opposite side of the road would be less.

S 216th Station Options

The potential additional station at S 216th Street (West option) would reduce the number of noise impacts by 277 because the alignment would be relocated in a trench along the west side of SR 99, farther away from several multi-family buildings. With this option, there would be one less Category 3 noise impact, because the Jesus Christ Salt and Light Church would no longer have a noise impact.

With the potential additional station at S 216th Street (East option), the number of impacts would decrease by 14. Category 3 noise impacts with the S 216th East Station Option would be the same as discussed above under the SR 99 Alternative.

Kent/Des Moines Station Options

The Kent/Des Moines HC Campus Station Option would be closer to the residences west of SR 99 but would decrease the number of impacts by 154 because it would mostly be located in a trench. If the Kent/Des Moines HC Campus Station Option were to connect to the S 216th West Station Option however, there would be a substantial decrease in impacts (1,042) due to the alignment being located in a trench for the majority of the distance. Category 3 impacts would no longer occur for the Citadel Church and Open Door Baptist Church because both would be displaced by this option.

Under the Kent/Des Moines SR 99 Median Station Option, there would be 8 more noise impacts because of moving closer to noise-sensitive receivers on the east side of SR 99. There would be no change in the Category 3 noise impacts.

The Kent/Des Moines SR 99 East Station Option would increase noise impacts by 16 because of moving closer to noise-sensitive receivers on the east side of SR 99. The Category 3 noise impacts with this option would be the same as under the SR 99 Alternative.

S 260th Station Options

With the potential additional station at S 260th Street (West option), noise impacts would be reduced by 150 because of a greater distance from noise-sensitive receivers and less development on the east side of SR 99 in this area. FTA Category 3 noise impacts would be the same as under the SR 99 Alternative, with the exception of the Woodmont Library, where the alignment would be farther away and the noise levels would be lower, thus eliminating this impact.

With the potential additional station at S 260th Street (East option), noise impacts would be reduced by 6. There is also one fewer FTA Category 3 noise impact under the S 260th West Station Option because of the displacement of the Seattle Full Gospel Church.

S 272nd Redondo Trench Station Option

With the S 272nd Redondo Trench Station Option, noise impacts would be reduced by 519 because the option would be located in a trench for most of its length. FTA Category 3 noise impacts would be reduced by two, at the Woodmont Library and Smart Start Day Care.

Federal Way SR 99 Station Option

Relative to the SR 99 Alternative, the Federal Way SR 99 Station Option would have 44 additional impacts because a hotel that would be displaced by the SR 99 Alternative would remain with this option. FTA Category 3 impacts would be the same as with the SR 99 Alternative.

I-5 Alternative

The I-5 Alternative would have 1,450 noise impacts. All impacts would be to single- and multi-family residences and hotels. The impacts would be distributed throughout the entire length of the alternative, and many of the properties where impacts would occur are multi-family complexes or motels, which would increase the number of impacts. There are no FTA Category 3 noise impacts under the I-5 Alternative, because all the Category 3 sites are far enough from the alignment to have reduced noise levels, or, in the case of the Mark Twain Elementary School, the alignment is in a deep covered trench, which would shield the school from the noise.

None of the options described below would have impacts on any Category 3 receivers.

Kent/Des Moines Station Options

With the Kent/Des Moines At-Grade Station Option, the number of impacts would increase by 41. The change in noise impacts would be

due to the realignment of the guideway and a difference in displacements near the Kent/Des Moines At-Grade Station.

With the Kent/Des Moines SR 99 East Station Option, there would be an increase of 103 impacts because the alignment would move closer to SR 99, which is closer to more noise-sensitive receivers.

Landfill Median Alignment Option

With the Landfill Median Alignment Option, there would be additional noise impacts along the east side of I-5 where the alignment would be in the I-5 median. Some impacts near S 244th Street on the west side of I-5 would not occur due to the alignment moving farther to the east compared to the I-5 Alternative. This would increase noise impacts by 73. No Category 3 impacts were identified under the Landfill Median Alignment Option.

Federal Way City Center Station Options

Relative to the I-5 Alternative, the Federal Way I-5 Station Option would increase impacts by 20 because of new impacts at a hotel near the Federal Way I-5 Station Option. No new Category 3 impacts were identified with the Federal Way I-5 Station Option.

With the Federal Way S 320th Park-and-Ride Station Option, the alignment would be farther away from several large multi-family complexes north of S 317th Street. This would reduce noise impacts by 120, although there would be new impacts on a hotel and mobile home park south of S 320th Street.

SR 99 to I-5 Alternative

With the SR 99 to I-5 Alternative, there would be 2,190 noise impacts. North of Kent-Des Moines Road, the impacts would be similar to the SR 99 Alternative.

As the alignment transitions from SR 99 to I-5 near the Kent-Des Moines Road, there would be 419 impacts. South of S 240th Street, the impacts would be the same as with the I-5 Alternative. Three Category 3 noise impacts were identified under the SR 99 to I-5 Alternative, at the Citadel Church, the Open Door Baptist Church, and the Jesus Christ Salt and Light Church.

Impacts from station options would be the same as described above under the SR 99 or I-5 alternatives.

I-5 to SR 99 Alternative

With the I-5 to SR 99 Alternative, there would be 2,942 noise impacts. North of Kent-Des Moines Road, the impacts would be the same as

with the I-5 Alternative. As the alignment transitions from I-5 to SR 99 near the Kent-Des Moines Road, there would be 202 impacts. South of S 240th Street, the impacts would be the same as with the SR 99 Alternative.

Impacts from station options would be the same as described above under the SR 99 or I-5 alternatives with the exception of the S 260th West Station Option. This option would only reduce the number of noise impacts by 83 (less than would occur with the SR 99 Alternative) because the location where it would exit the SR 99 median would be farther south, at approximately S 246th Street.

4.7.4.4 Noise Impacts from Park-and-Rides and Stations

Noise from park-and-rides and stations with parking lots and garages was evaluated for noise impacts under the FTA and local noise control ordinances. For all stations and station options, no impacts would occur under the FTA criteria for station impacts.

SR 99 Alternative Stations

Under the SR 99 Alternative, there are 8 noise impacts predicted under the local noise ordinance at a mobile home park near the Kent/Des Moines SR 99 West Station Option. No noise impacts are predicted near the S 272nd Redondo Station or the Federal Way Transit Center under the local noise ordinances.

SR 99 Station Options

The Kent/Des Moines HC Campus Station Option would have no noise impacts from the park-and-ride or station. The Kent/Des Moines SR 99 Median Station Option and the Kent/Des Moines SR 99 East Station Option would have the same impacts as the Kent/Des Moines SR 99 West Station. The S 272nd Redondo Trench Station Option and the Federal Way SR 99 Station Option would have no noise impacts under the local noise ordinances.

I-5 Alternative Stations

There are no station-related noise impacts predicted under the I-5 Alternative.

I-5 Station Options

The only I-5 station option with a change in noise impacts is the Kent/Des Moines SR 99 East Station Option, with 8 noise impacts at a mobile home park under the local noise ordinance. The Kent/Des Moines At-Grade Station Option, Federal Way I-5 Station Option, and Federal Way S 320th Park-and-Ride Station Option would all have no noise impacts.

SR 99 to I-5 Alternative

There are no station-related noise impacts predicted under the SR 99 to I-5 Alternative. None of the station options would have any impacts.

I-5 to SR 99 Alternative

With the Kent/Des Moines 30th Avenue West Station Option there would be 8 noise impacts under the local noise ordinance. There would be no noise impacts from the S 272nd Redondo Station or the Federal Way Transit Center Station, and no station noise impacts are predicted for the station options.

4.7.4.5 Traffic Noise Assessment

There are a limited number of locations in the project corridor where new roads would be constructed or where existing shielding would be removed (in the case of buildings) or relocated (in the case of existing sound walls). Predicted noise impacts from light rail operations, particularly from elevated alignments, can affect two to three rows of noise-sensitive receivers. Where the light rail alignment is within or adjacent to roadways or the highway, it is unlikely that potential increases in exposure to existing traffic noise would occur at properties not already identified as impacted by light rail noise. In addition, the light rail guideway (including sound barriers for light rail noise mitigation) and other project elements (such as garage structures or elevated stations) would provide some shielding from traffic noise. Areas with potential for increased traffic noise levels are described by alternative below. Traffic noise will be evaluated in the Final EIS for the Preferred Alternative where the conditions described above occur.

SR 99 Alternative

There are multiple locations along the SR 99 corridor that currently meet or exceed 66 dBA during the peak hour of traffic noise. Because of the speed of vehicles on SR 99 and the spacing of intervening buildings, traffic noise levels at or above 66 dBA are likely to occur up to 250 to 400 feet from the curb line of the roadway, depending on existing shielding and topographical conditions in the area. In areas with cross streets that are also major arterials with high traffic volumes, the distance to the NAC could increase to over 400 feet, as noise from some major arterials also currently meets or exceeds the NAC.

Areas where property acquisitions and roadway alterations associated with the SR 99 Alternative might result in traffic noise levels exceeding the NAC at nearby homes include:

- The new S 236th Lane that would be constructed for access to the Kent/Des Moines station and/or parking associated with the SR 99 Alternative and its options
- The S 272nd Redondo Station (including the trench option for this station), where a new road would be constructed for access to S 272nd Street

Other areas affected by the SR 99 Alternative could have increased exposure to traffic noise by removal of buildings. Properties in these areas would already be subject to light rail noise impacts and/or park-and-ride noise impacts (if located near a station). The design of the station and parking structures may provide new shielding and reduce the potential for traffic noise impacts.

SR 99 Station Options

Exposure to traffic noise could occur with the all station options where buildings that currently provide shielding would be removed, except the Kent/Des Moines HC Campus Station Option and the Federal Way SR 99 Station Option. Properties that could have increased exposure to traffic noise in these areas would already be subject to light rail noise impacts.

I-5 Alternative

Traffic noise at properties adjacent to I-5 may currently be influenced by physical shielding (e.g., from berms and other structures), noise walls, and topography. In most areas, existing noise levels are 66 dBA or greater. Based on measured noise levels and proximity to I-5 travel lanes, the NAC is exceeded at distances up to 400 to 600 feet from I-5, and most existing shielding is not effective at reducing noise levels. For example, typical daytime noise levels behind an existing traffic noise wall at the Camelot Square Manufactured Home Park were measured at 69 to 73 dBA Leq.

Areas where property acquisitions and roadway alterations associated with the I-5 Alternative might result in traffic noise levels exceeding the NAC at nearby homes include:

- The new S 236th Lane that would be constructed for access to the Kent/Des Moines station and/or parking

- The realignment of 28th Avenue S north of the Star Lake Park-and-Ride

Other areas affected by the I-5 Alternative could have increased exposure to traffic noise by removal of buildings. In addition, an existing sound wall would be relocated at the Camelot Square Mobile Home Park, south of S 288th Street.

The design of the station and parking structures may also provide new shielding and reduce the potential for traffic noise impacts where they could occur near stations.

I-5 Station and Alignment Options

The only station or alignment option that would have potential for traffic noise impacts would be the Federal Way S 320th Park-and-Ride Station Option, where there would be a loss of shielding south of S 324th Street on the east side of the Belmor Mobile Home Park. The Kent/Des Moines At-Grade Station Option would have a station access road at S 242nd Street instead of S 236th Street, but there are no noise sensitive land uses in this area.

SR 99 to I-5 Alternative

Potential for traffic noise impacts from the SR 99 to I-5 Alternative would be the same as both the SR 99 Alternative north of Kent/Des Moines Road and the I-5 Alternative south of S 240th Street. The Kent/Des Moines 30th Avenue East Station would also include the S 236th Lane extension and therefore would have potential for traffic noise impacts. As with the SR 99 and I-5 alternatives, mitigation for park-and-ride noise may mitigate any traffic noise impacts as well. Potential for traffic noise impacts from station options would be the same as for the potential additional stations at S 216th Street and the Federal Way S 320th Park-and-Ride Station Option.

I-5 to SR 99 Alternative

Potential for traffic noise impacts from the I-5 to SR 99 Alternative would be the same as both the I-5 Alternative north of Kent/Des Moines Road and the SR 99 Alternative south of S 240th Street. The Kent/Des Moines 30th Avenue West Station would also include the S 236th Lane extension and therefore would have potential for traffic noise impacts. As with the SR 99 and I-5 alternatives, mitigation for park-and-ride noise may mitigate any traffic noise impacts as well. Potential for traffic noise impacts from station options would be the same as for the potential additional stations at S 260th Street.

4.7.4.6 Vibration Impacts from Build Alternatives

Table 4.7-5 summarizes the vibration impacts for the FWLE alternatives from light rail operations. For multi-family buildings with vibration impacts, the actual number of units with impacts at each specific building would be determined following additional testing that is performed during preliminary or final project design.

TABLE 4.7-5
Summary of Projected Vibration Impacts from Light Rail Operations

Alternative	Number of Vibration Impacts (Range with Options)		Potential Mitigation[a,b]
	Before Mitigation	After Mitigation	
SR 99 Alternative	**50** (0-271)	**0** (0-0)	HCDF
I-5 Alternative	**222** (202-225)	**0** (0-0)	HCDF, LIC, and ballast mat
SR 99 to I-5 Alternative	**209** (209-227)	**0** (0-0)	HCDF
I-5 to SR 99 Alternative	**45** (45-238)	**0** (0)	HCDF

[a] HCDF = high-compliance direct-fixation fastener. It is used as mitigation for aerial sections with direct-fixation tracks. For at-grade and trench sections, ballast mats, which are rubber mats placed between the track ballast and the ground, are recommended for vibration mitigation.
[b] LIC = low-impact crossover, or special track work. A LIC is a crossover where the gap in the rail is closed, preventing increased vibration as the train crosses over the crossover.

The impacts identified and described in the sections below are based on the distance between the proposed tracks and the individual buildings, the type of track (elevated, trench, or at-grade), and the speed of the light rail vehicle. In most cases, vibration impacts are limited to buildings within 50 feet of elevated structures. Because the vibration from elevated structures enters the ground at the location of the guideway columns, this analysis assumes that columns could be installed anywhere along the alignment. During preliminary or final design, the actual location of the support pillars would be developed and the vibration analysis would be revised, which could result in a reduction in the number of vibration impacts.

SR 99 Alternative

Under the SR 99 Alternative, there would be 50 vibration impacts at a hotel with two buildings. No other vibration impacts are predicted because the alignment is mainly in the center of the roadway on structure, reducing the level of vibration emitted to the ground.

S 216th Station Options

The potential additional station at S 216th Street (West option) would not have any vibration impacts, a decrease in 50 impacts. With the

potential additional station at S 216th Street (East option), additional vibration impacts would occur at one hotel.

Kent/Des Moines Station Options

With the Kent/Des Moines HC Campus Station Option, there would be 12 additional vibration impacts at multi-family buildings. If the Kent/Des Moines HC Campus Station Option were connected to the S 216th West Station Option, there would be vibration impacts at six additional single- and multi-family residences along this alignment. Fifty impacts would no longer occur at a hotel that would be displaced, however, and the overall number of impacts with this combination would decrease by 22. Finally, the other two Kent/Des Moines station options, SR 99 Median and SR 99 East, would not have any additional impacts.

S 260th Station Options

With the potential additional station at S 260th Street (West option), there would be three additional potential vibration impacts at multi-family residences. With the potential additional station at S 260th Street (East option), there would be potential vibration impacts at two additional single-family residences along the alignment.

S 272nd Redondo Trench Station Option

With the S 272nd Redondo Trench Station Option, 181 additional vibration impacts would occur at single-family residences, multi-family residences, and one hotel.

Federal Way SR 99 Station Option

There would be no additional vibration impacts with the Federal Way SR 99 Station Option.

I-5 Alternative

There would be 10 properties, representing 222 units, which would have vibration levels that exceed the FTA vibration criteria with the I-5 Alternative. Impacts would occur at two single-family residences, six multi-family residences, and two hotels. There would be no additional impacts with the Landfill Median Alignment Option.

Kent/Des Moines Station Options

With the Kent/Des Moines At-Grade Station Option, potential vibration impacts would occur at one additional single-family property. With the Kent/Des Moines SR 99 East Station Option, there would be 20 fewer vibration impacts.

Federal Way City Center Station Options

The Federal Way I-5 Station Option would not have any additional impacts. The Federal Way S 320th Park-and-Ride Station Option would have potential vibration impacts at one mobile home park.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would have 209 impacts, with impacts north of Kent-Des Moines Road the same as the I-5 Alternative and the impacts south of S 240th Street the same as the SR 99 Alternative. There would be 1 multi-family structure with a total of 2 units that would have vibration levels exceeding the FTA vibration criteria along 30th Avenue South between Kent-Des Moines Road and S 240th Street.

Impacts with the S 216th West and Federal Way I-5 station options would be the same as described above under the SR 99 and I-5 alternatives.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would have 58 impacts, with impacts north of Kent-Des Moines Road the same as the SR 99 Alternative, and impacts south of S 240th Street the same as the I-5 Alternative. Impacts under the Federal Way SR 99 Station Option are the same as the I-5 to SR 99 Alternative.

Impacts from station options would be the same as described above under the SR 99 or I-5 alternatives for applicable station and alignment options, except for the S 260th West Station Option. For this option, there would be no additional impacts because it would be located farther from the sensitive receivers on the west side of SR 99 that are impacted with this option when it connects to the SR 99 Alternative.

4.7.4.7 Groundborne Noise Impacts

Groundborne noise impacts were not assessed for FTA Category 1, 2, and 3 sensitive receivers because the track for all alternatives and options is above or just below ground level and airborne noise effects from normal operations are higher than those from groundborne noise. The Performing Arts Center at Federal Way High School (currently under construction), which qualifies as a special building, would be located within 100 feet of the proposed tracks for the SR 99 Alternative and the I-5 to SR 99 Alternative. Groundborne noise levels at this location would be 35 dBA, which is 10 dBA above the FTA criteria of 25 dBA, resulting in a potential groundborne noise impact

on this facility from these alternatives. There are no special buildings near the I-5 Alternative and the SR 99 to I-5 Alternative, and therefore there are no groundborne noise impacts for these alternatives.

4.7.5 Potential Mitigation Measures

4.7.5.1 Noise Mitigation

Sound Transit is committed to minimizing noise levels at the source for all transit corridors it operates, including the FWLE. This includes using state-of-the-art vehicles equipped with wheel skirts to reduce noise. In addition, Sound Transit has committed to a maintenance program that includes periodic rail grinding or replacement, wheel truing or replacement, vehicle maintenance, operator training, and lubrication of curves with a radius of less than 600 feet near noise-sensitive areas, which all help to reduce noise levels along transit corridors. For noise impacts that would still exist after these source noise treatments, potential noise mitigation measures that are consistent with Sound Transit's Light Rail Noise Mitigation Policy (Motion No. M2004-08) would be provided. During final design, all potential impacts and mitigation measures would be reviewed for confirmation. During preliminary and final design, if it is discovered that mitigation could be achieved by a less costly means or if the detailed analysis shows no impact, then a mitigation measure may be eliminated or modified. After light rail operations have started, if the resulting noise exceeds FTA criteria, then more mitigation may be required.

The potential mitigation options available for noise from FWLE transit operations would primarily be sound walls. Sound walls would be proposed where feasible and reasonable, as determined by Sound Transit based on specific site conditions. Sound walls would be located along the side of the guideway structure for elevated profiles, and on the ground for at-grade or trench profiles. Sound walls are preferred because they are effective at reducing noise at the source.

Another potential mitigation measure is special track work, which includes movable point or spring rail frogs, which eliminate the gap between tracks at crossovers that causes noise and vibration at these locations.

When source mitigation measures or sound walls are infeasible or not entirely effective at reducing noise levels below the FTA impact criteria, residential sound insulation would be evaluated and implemented for affected properties where the existing building does

not already achieve a sufficient exterior-to-interior reduction of noise levels. Most new buildings have good exterior-to-interior noise reduction, and additional sound insulation might not be necessary.

4.7.5.2 Park-and-Ride and Station Noise Mitigation

Noise mitigation for the park-and-rides includes station design and sound walls. Station design can include designing the parking garages with short noise barriers, and modifying the entrances and exits to place them away from nearby noise-sensitive properties. In addition, noise barriers can be placed between the station and the noise-sensitive properties, reducing noise levels and eliminating noise impacts.

4.7.5.3 Potential Traffic Noise Mitigation

Potential traffic noise impacts could likely be mitigated in conjunction with the proposed light rail mitigation. In most of these areas, mitigation for impacts specific to traffic noise would be considered where mitigation for transit or park-and-ride noise impacts is not sufficient.

Additional mitigation may need to be considered for the realignment of 28th Avenue S and the north end of Camelot Square Mobile Home Park, where the I-5 Alternative would be elevated over S 288th Street and the existing sound wall would be relocated. The replacement sound wall would be modeled using future traffic volumes for the project design year (2035) to assure that it would continue to mitigate traffic noise into the future. The replacement sound wall would be designed such that there would be no new traffic noise impacts and no increase in the severity of any existing traffic noise impacts. The wall may also be designed to mitigate any light-rail-related noise impacts in addition to the traffic noise.

4.7.5.4 Vibration and Groundborne Noise Mitigation

Vibration and groundborne noise impacts that exceed FTA criteria would be mitigated when determined to be reasonable and feasible. The locations requiring mitigation would be refined during the FWLE preliminary and final design process. There are some locations where the light rail guideways would be close to buildings; therefore, vibration mitigation might be more difficult.

Mitigation could include the use of high compliance direct fixation (HCDF) fasteners to provide vibration isolation between rails and concrete slabs. These fasteners include a resilient element between

the rail and concrete to provide greater vibration isolation than standard rail fasteners.

For at-grade segments, where ballast and tie track are used, there are two potential forms of vibration mitigation. The most common form is the use of ballast mats, which consist of a pad made of rubber or rubberlike material placed on an asphalt or concrete base with the normal ballast, ties, and rail on top. The reduction in groundborne vibration provided by a ballast mat is strongly dependent on the vibration frequency content and the design and support of the mat. A relatively new form of vibration mitigation for ballast and tie installations includes the use of tire-derived aggregate (TDA), instead of the standard ballast. TDA consists of shredded tires wrapped with filter fabric that is added to the base below the track ties.

To mitigate vibration impacts related to the added vibration from track crossovers, special track work could be employed. Special track work includes movable point or spring rail frogs, which eliminate the gap between tracks at crossovers that causes increased vibration.

4.8 Water Resources

4.8.1 Summary

The FWLE would increase the amount of impervious surface compared to existing impervious surfaces in the study area by between 14 percent for the SR 99 Alternative and 140 percent for the I-5 Alternative (see Table 4.8-1). This could potentially result in impacts to water quality; however, stormwater management and best management practices would be implemented for all light rail alternatives to protect surface waters from the additional surface runoff.

TABLE 4.8-1
Summary of Changes in Impervious Surface Within Alternative Footprints

Alternative	Existing Impervious Surface in Acres (Range with Options)	Proposed Impervious Surface in Acres (Range with Options)	% Increase in Impervious Surface (Range with Options)
SR 99 Alternative	**104** (81-123)	**119** (92-135)	**14** (10-14)
I-5 Alternative	**30** (24-40)	**72** (69-81)	**140** (102-189)
SR 99 to I-5 Alternative	**42** (41-57)	**76** (76-91)	**80** (61-84)
I-5 to SR 99 Alternative	**95** (69-101)	**111** (88-114)	**17** (13-27)

Note: The ranges provided show the potential range of impacts when each alternative is combined with one or more of its station or alignment options.

There would be five stream crossing locations with one or more alternatives or options. At four locations, stream impacts would be avoided by spanning the stream crossing with an elevated guideway. The I-5 Alternative would require relocation and/or piping of approximately 800 feet of Bingaman Creek in the stream's upper reach. With the exception of the relocation of Bingaman Creek, the project was found to have no adverse impacts on surface water bodies. All alternatives would be located within wellhead protection zones for Highline Water District in SeaTac and Lakehaven Utility District in Federal Way, but with appropriate design and best management practices, no adverse impacts to groundwater are expected.

4.8.2 Introduction to Resources and Regulatory Requirements

This section describes the affected water resources and potential hydrologic, flooding, and water quality impacts associated with the Federal Way Link Extension (FWLE) alternatives.

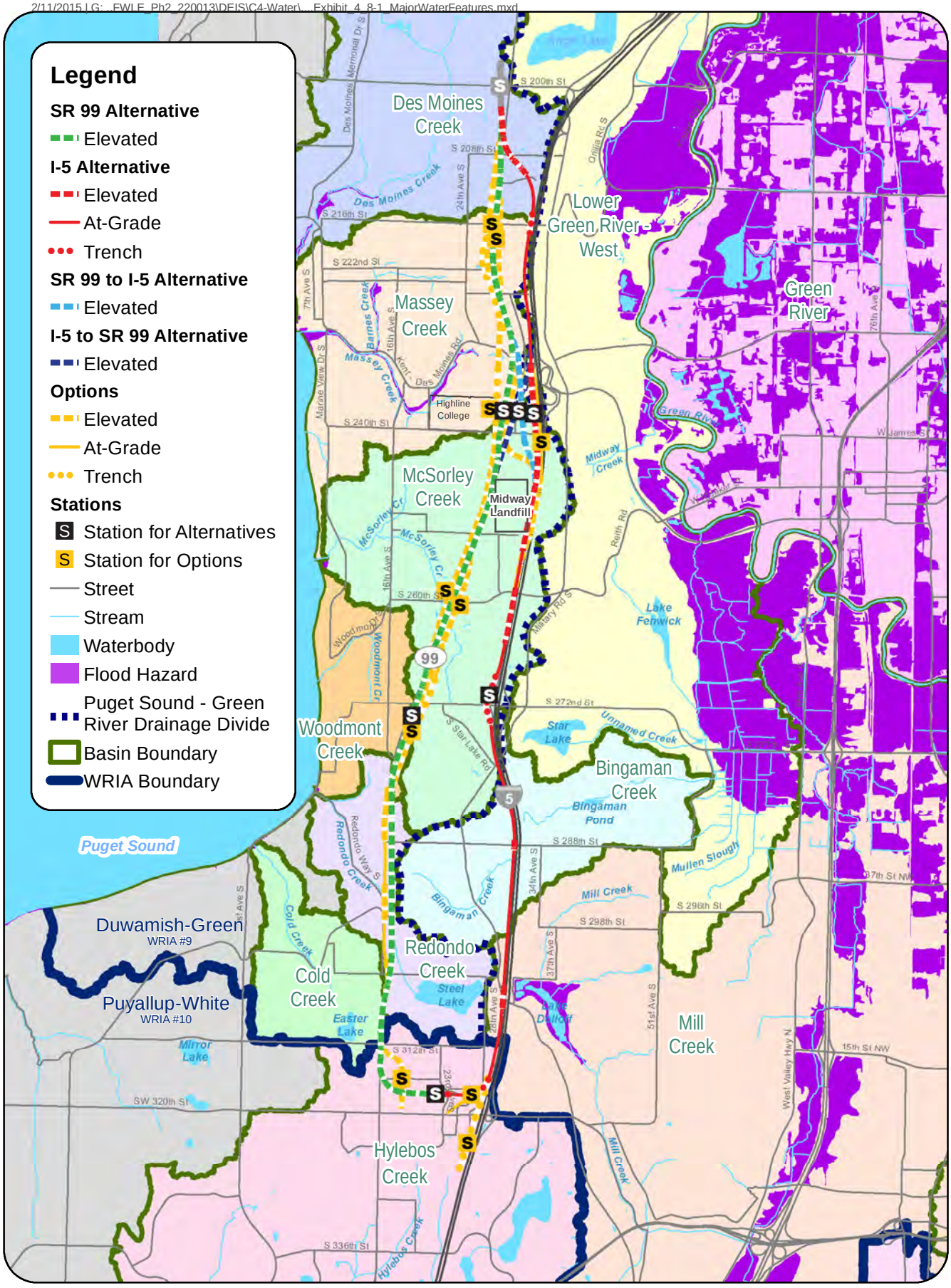
Appendix D4.8, Water Resources, contains the following supporting information:

- A list of relevant laws, ordinances, and guidelines
- A table of designated water uses for the water bodies in the study area
- A list of applicable stormwater ordinances and manuals
- Maps of major surface water bodies and stormwater facilities in the study area and hydrologic soil groups
- A table of changes in impervious surface
- Best management practices (BMPs) for stormwater impacts

A detailed discussion of wetlands, stream habitat, and stream/wetland buffers is presented in Section 4.9, Ecosystems.

4.8.3 Affected Environment

The study area for water resources consists of the stream basins within which the project would be constructed (Exhibit 4.8-1). Most of the study area lies along the topographic ridge that drains west to Puget Sound and east to the Green River valley within the Duwamish/Green Water Resources Inventory Area (WRIA) 9. The southern end of the study area is within the Puyallup/White WRIA 10. Topography in the study area ranges from a high elevation of roughly 500 feet along the SR 99/I-5 corridor to sea level at Puget Sound. Virtually all of the study area crossed by the FWLE alternatives is urbanized. The greatest areas of development are along the SR 99 corridor and in the area surrounding the Federal Way Transit Center. Other areas are characterized by lower-density residential development and greater concentrations of vegetation. following sections address surface waters, floodplains, groundwater, and stormwater management.



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.5 1 2 Miles

EXHIBIT 4.8-1
Major Water Features

Federal Way Link Extension

4.8.3.1 Surface Water

Exhibit 4.8-1 shows the major streams within the study area. Given the relatively narrow width and steep sides of the study area, the local streams are generally short and no more than a few miles long.

The west side of the study area drains to the East Passage of Central Puget Sound. The primary streams in the study area that flow to Puget Sound include Des Moines Creek, Massey Creek, McSorley Creek, and Redondo Creek. The primary streams flowing east to the Green River include Bingaman Creek and Mill Creek, both in the southeastern portion of the study area.

The southernmost portion of the study area encompasses the northern end of the Hylebos Creek Basin. Runoff from this portion of the Hylebos Basin flows south to a large wetland south of S 348th Street. The wetland is the headwaters of Hylebos Creek, which flows south and then west, emptying into Commencement Bay east of downtown Tacoma.

All of these stream basins are highly urbanized and exhibit high stream flows (peak flows) during storm events, a characteristic typical of developed basins. Urbanization has also changed base flow and increased seasonal flow fluctuations from pre-development conditions. These changes can have major effects on the physical, biological, and chemical nature of the stream. More information on these stream characteristics is available in the FWLE Ecosystems Technical Report, Appendix G2.

A basin plan was developed for Des Moines Creek (Des Moines Basin Committee, 1997) that recommended a large regional detention facility be constructed in the basin to reduce peak stormwater runoff. A basin plan was also prepared for Hylebos Creek (King County Surface Water Management Division, 1991). There are several large regional detention ponds in the upper portion of the basin, and some stream and riparian restoration projects have been carried out in the middle reaches of the basin.

Lakes in the study area include Angle Lake, Star Lake, Steel Lake, and Lake Dolloff. These lakes are of moderate size and have a relatively small area contributing runoff.

The shorelines of Angle Lake, Star Lake, and Steel Lake are almost completely developed with single-family residences, docks, and piers. These lakes have good to excellent water quality. Lake Dolloff is

undeveloped along its north side, with low-density residential development along the remaining shoreline. Lake Dolloff is classified as having fair water quality but is considered eutrophic.

Eutrophic

A lake is eutrophic when it has high levels of nutrients that promote high algae production (algal blooms). This typically results in periods of very low water clarity. This can also result in low dissolved oxygen levels in the lake water that can adversely affect aquatic species (King County Lakes Program, 2013).

Under the Washington Administrative Code (WAC) 173-201A, the state Department of Ecology (Ecology) has assigned water uses to each of the water bodies in the study area. These are shown in Appendix D4.8. These uses define the water quality standards that must be met for each water body. Ecology prepares a state-wide water quality assessment on a periodic basis to develop a list of impaired waters that do not meet water quality standards, also known as the 303(d) Impaired Waters List. Water bodies in the study area not meeting Ecology's water quality standards for criteria are summarized in Table 4.8-2. Within the study area, bacteria and dissolved oxygen are the two parameters that most commonly do not meet Ecology's water quality standards. Water quality violations are also shown for copper in Des Moines, Massey, and McSorley creeks. However, a recent study failed to find water quality violations for copper in these three streams and recommended that the 303(d) List be modified accordingly (Ecology, 2012a).

TABLE 4.8-2
Water Bodies Not Meeting Water Quality Standards (303[d] List)

	Dissolved Oxygen	Bacteria	Copper	PCBs (tissue)	Bioassessment
East Passage (Puget Sound)		✓		✓	
Des Moines Creek	✓	✓	✓		
Massey Creek	✓		✓		
McSorley Creek	✓	✓	✓		
Redondo Creek		✓			
Unnamed Creek[a]	✓	✓			
Hylebos Creek	✓				✓

Source: Ecology, 2013.
[a] Flows from Star Lake to the Green River.
PCBs = polychlorinated biphenyls

4.8.3.2 Floodplains

Flood insurance rate maps (FIRMs) have been published by the Federal Emergency Management Agency for the study area (Federal Emergency Management Agency, 1995). Only two flood hazard areas have been mapped within to the study area, but are not within 200 feet of any of the alternatives. One of them follows the upper portion of the south fork of Massey Creek, west of SR 99 (Exhibit 4.8-1). The second flood hazard area is located around Lake Dolloff, and extends to the east side of Interstate 5.

4.8.3.3 Groundwater

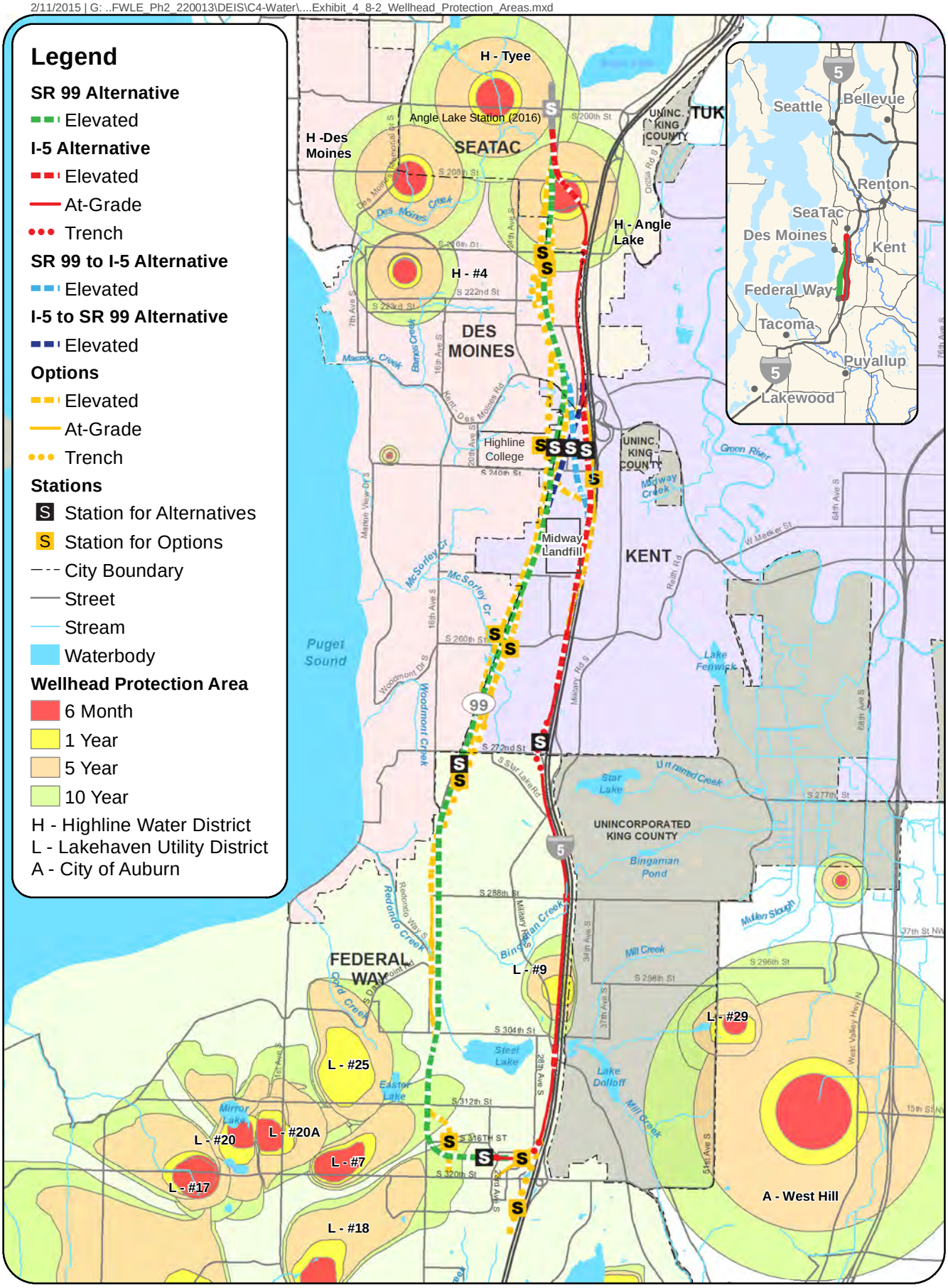
There is no U.S. Environmental Protection Agency (EPA)-designated Sole Source Aquifer within the study area. However, groundwater provides an important municipal water supply in the southern portion of the study area. Wellhead protection zones have been designated around a number of municipal drinking water supply wells in the study area (Exhibit 4.8-2). Each zone defines an area of land where infiltrating water would take a given period of time to directly recharge the municipal well. Four zones representing recharge times of 6 months, 1 year, 5 years, and 10 years are typically shown. Wells in the study area with wellhead protection areas include:

- Highline Water District: #14, Des Moines, Tyee, and Angle Lake wells
- Lakehaven Utility District: Wells #7, #9, #17, #18, #20, #20A, #25 and #29

Midway Landfill, operated by the City of Seattle, is a Superfund site that was closed in 1983, after which groundwater monitoring indicated that contaminants had entered the groundwater (EPA, 2000). Leachate from the landfill has migrated though the base of the landfill and entered a relatively porous formation known as the Upper Gravel Aquifer. It subsequently flowed to the underlying Southern Gravel Aquifer, which flows both east and west. The volatile organic compounds (VOCs) 1, 2-dichloroethane and vinyl chloride were the primary contaminants of concern.

Remedial actions were undertaken in the 1990s to address the contamination. The landfill was capped and offsite run-on to the landfill was diverted. A stormwater pond was constructed to treat surface runoff from the landfill. Discharge from that pond enters McSorley Creek. These and other actions greatly reduced the amount of leachate from the landfill, causing groundwater levels below the landfill to fall. Concentrations of VOCs in downgradient wells have also declined and are now below or approaching the Remedial Action Goals for the landfill (EPA, 2010).

An additional contaminant, 1, 4-dioxane, was detected in the groundwater in 2005 and has been added to the list of monitored compounds. Both 1, 2-dichloroethane and vinyl chloride are known to exist in monitoring wells upgradient of the landfill. This indicates that



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013). Washington Department of Health (2014)

EXHIBIT 4.8-2
Wellhead Protection Areas

there are additional sources of these contaminants, outside of the Midway Landfill.

More information on the Midway Landfill can be found in Section 4.11, Geology and Soils, and Section 4.12, Hazardous Materials.

4.8.3.4 Stormwater Management

Due to existing development within the study area, an extensive stormwater drainage system exists along the project alternatives. The stormwater ordinances and manuals applicable to each of the four cities in the FWLE corridor are listed in Appendix D4.8. With the exception of Kent, which has its own manual, the cities have adopted the 2009 King County *Surface Water Design Manual* (King County Department of Natural Resources and Parks, 2009). The cities of Kent, SeaTac, and Federal Way have developed addendums to the King County manual that address local concerns. The King County manual is currently being revised and is expected to be released in 2015. Washington State Department of Transportation (WSDOT) stormwater management design standards would apply to the portion of the project that lies within WSDOT right-of-way, although WSDOT may apply the standards of the local jurisdiction.

Meetings were held with stormwater staff at each of the cities to discuss the project, identify possible drainage issues, and gather relevant information. SR 99 and associated stormwater facilities have been upgraded through all four jurisdictions within the past decade. As a result, none of the jurisdictions experience any serious drainage problems along that corridor (personal communications with Will Appleton, Mike Bryan, Loren Reinhold, and Beth Tan, May 2013). Only one major stormwater facility upgrade is planned within the project corridor. The existing Executel Pond (refer to Appendix Exhibit D4.8-1a), located in the northern portion of the study area (in the city of SeaTac, west of SR 99), will be impacted by the planned extension of SR 509 (HNTB, 2004). As a result, this pond will be relocated to the west of its existing location (personal communication, Mike Bryan, May 30, 2013). A large wetland lies along the upper reach of the South Fork of McSorley Creek, upstream of SR 99. Proper stormwater management for the protection of this critical area is a priority for the City of Kent (B. Tan, personal communication, 2013).

WSDOT operates a drainage system serving I-5. Most of the drainage system was originally installed when the area surrounding I-5 was

undeveloped, and much of the system consists of ditches that drain either to local streams or to the drainage systems of the adjacent cities. A few detention ponds have been constructed to manage road runoff as part of highway improvements over the past several decades. WSDOT reports that there are no substantial flooding or local drainage problems associated with I-5 within the study area (A.L. Williams, personal communication, 2013). There are currently no major funded additions or improvements to the I-5 drainage system planned in the project vicinity by WSDOT.

4.8.4 Environmental Impacts

4.8.4.1 No Build Alternative

Under the No Build Alternative, light rail would not be extended in the FWLE corridor and the potential impacts on water resources identified for the FWLE build alternatives would be avoided. As a result, there would be no direct water resource impacts associated with this alternative. However, the water quality benefits from stormwater treatment associated with the proposed project would not be realized.

4.8.4.2 Build Alternatives

This section describes the direct and indirect impacts of the FWLE alternatives on water resources. Construction impacts are discussed in Chapter 5.

Direct Impacts

Potential long-term impacts on water resources were initially assessed using GIS to overlay alternative footprints on a map of surface water bodies and identify stream crossings by alternative or option. These crossings and the characteristics of the associated water bodies were then visually reviewed in the field. GIS data of impervious surfaces in the study area were combined with design data layers to determine the change in impervious area and pollution-generating impervious surfaces (PGIS). No shorelines of the state, shorelines of statewide significance, or designated floodplains lie within 200 feet of any constructed features of this study area. Therefore these resources would not be impacted and are not discussed further.

Direct impacts that would be permanent in nature are described in this section, first by impacts that are common to all alternatives, and then by impacts specific to an alternative or option.

Impacts Common to All Alternatives

Sound Transit would minimize impacts on water resources through project design and development in compliance with stormwater management regulations. Examples of measures to control impacts include minimizing the extent of impervious surfaces, avoiding the placement of project elements in or near water resources where possible, and installing appropriate stormwater management facilities. Sound Transit's *Link Design Criteria Manual* (Sound Transit, 2012) requires stormwater facilities for its projects to conform to the requirements of local jurisdictions.

Chapter 30 of Sound Transit's *Link Design Criteria Manual* emphasizes sustainability measures, including low-impact development (LID) as a preferred stormwater management method, if appropriate and feasible. Also, the 2012 Ecology *Stormwater Management Manual for Western Washington* requires LID approaches to stormwater management to the extent feasible. Up to 50 percent of the project corridor, depending upon the alternative or option selected, is underlain by highly infiltrative soils that would likely be suitable for LID measures. Although the high degree of existing development may limit such opportunities, LID measures would be incorporated into project design where feasible.

Low-impact Development

LID is a stormwater and land use management strategy that strives to mimic pre-disturbance hydrologic processes by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices (BMPs) that are integrated into a project design. LID BMPs emphasize pre-disturbance hydrologic process of infiltration, filtration, storage, evaporation and transpiration. Common LID BMPs include: bioretention, rain gardens, permeable pavements, minimal excavation foundations, vegetated roofs, and rainwater harvesting. *Source:* http://www.ecy.wa.gov/programs/wq/stormwater/municipal/LID/Resources.html.

There are a number of existing stormwater facilities within the study area, as shown in Appendix D4.8. During detailed design, Sound Transit will explore the potential for joint use of these facilities to manage project runoff. The Executel Pond in the City of SeaTac and the stormwater facilities serving SR 99 and I-5 may be suitable for joint stormwater management.

Surface Water

To evaluate potential impacts to surface water, Sound Transit considered:

- *Increases in impervious surfaces*: Impervious surfaces increase runoff volumes that can escalate flooding and flow frequencies, which in turn can contribute to stream erosion. In addition, impervious areas subject to vehicular traffic and other pollution-generating activities accumulate contaminants that are transported to water bodies by stormwater runoff if not treated, which can negatively impact water quality.

- *Stream crossings*: All stream crossings would be on elevated guideways, but columns in and around stream channels or buffers can pose a risk to water quality. Potential stream impacts are summarized under the discussion of individual alternative and option impacts.
- *Type and size of parking facilities*: Most of the parking facilities would be located in areas of existing vehicular use, including existing parking facilities. The SR 99 Alternative has two out of three parking facilities within existing park and rides, while the I-5 Alternative has three out four parking facilities within existing park and rides. All project parking facilities would be designed to incorporate stormwater management features.
- *Proposed BMPs*: LID strategies would be considered in addition to stormwater treatment and flow control facilities.

Sound Transit is committed to designing the project to meet the stormwater management requirements of the local jurisdictions. The project would also comply with applicable permit requirements. Stormwater detention and treatment for all necessary project components would be incorporated into the project design, and stormwater would not be discharged directly into the stormwater drainage systems for SR 99 or I-5. For those portions of the project lying outside of these two roadways, the condition of the local drainage system would be reviewed with the appropriate jurisdiction. Appropriate management of project runoff would be developed to avoid intensifying any existing drainage problems. In addition, control of project runoff at its source using LID techniques would be implemented in project design, as site conditions allow.

Impervious Surfaces

FWLE would add both pollution-generating and non-pollution-generating impervious surfaces in the vicinity of the light rail alternatives. Runoff from pollution-generating impervious surfaces can increase pollutant loads to streams, causing water quality degradation. Pollution-generating impervious surfaces (PGIS) generally include station facilities such as parking areas, bus holding areas, and access roads, and also include road improvements needed to accommodate the project. Non-pollution-generating impervious surfaces include the light rail tracks (including ties and ballast), guideways, and station platforms.

Stormwater treatment would be provided for all runoff from project-related PGIS, thus protecting water quality. In general, runoff from non-PGIS surfaces would not be treated. Flow control would be provided for all runoff from project-related impervious areas. Additional information on calculation of the impervious surface and PGIS is presented in Appendix D4.8.

Groundwater

The project would result in a net increase of impervious area, as shown in Tables 4.8-1 and 4.8-3. This would reduce the amount of groundwater recharge within the general study area. The soils along the project alignments are generally conducive to onsite management of stormwater via infiltration. If LID features are incorporated into project design, it could offset the effects of any net decrease in pervious area. Thus, the project is not expected to substantially impact groundwater levels. Project stormwater runoff would be treated, as required, prior to release, and groundwater quality would not be adversely impacted.

TABLE 4.8-3
Proposed Changes in Impervious Surface in Acres (Range of Acreage with Options)

Alternative	Total Area	Existing Conditions			Conditions with FWLE Build Alternatives		
		Pervious	Impervious		Pervious	Impervious	
			PGIS	Non-PGIS		PGIS	Non-PGIS
SR 99 Alternative	**120** (97 to 136)	**17** (8 to 24)	**85** (63 to 104)	**19** (13 to 24)	**2** (1 to 2)	**97** (63 to 107)	**22** (22 to 39)
I-5 Alternative	**73** (69 to 78)	**43** (34 to 53)	**22** (18 to 33)	**8** (5 to 9)	**1** (1 to 1)	**38** (36 to 44)	**34** (31 to 37)
SR 99 to I-5 Alternative	**76** (76 to 92)	**34** (33 to 39)	**33** (31 to 47)	**9** (9 to 15)	**1** (1 to 1)	**45** (45 to 57)	**31** (31 to 37)
I-5 to SR 99 Alternative	**113** (92 to 115)	**18** (14 to 20)	**78** (59 to 85)	**17** (12 to 17)	**2** (1 to 2)	**82** (57 to 84)	**29** (29 to 34)

PGIS = pollution-generating impervious surface.

A number of sections of the alternatives and design options would lie within excavated trenches generally ranging in depth from 20 to 40 feet. The trenches would be constructed with solid concrete sides and bottoms designed to permanently maintain the integrity of the trench. The trench lining would be water-tight to avoid seepage of groundwater into the trench. Some local changes in groundwater flow paths might occur but no significant long-term groundwater impacts are expected to occur.

All alternatives would cross two wellhead protection zones at the north end of the study area (Angle Lake Well and Tyee Well; Exhibit 4.8-2). Both wells are operated by the Highline Water District and lie within the city of SeaTac. The city of SeaTac can place special requirements for projects located in a critical recharge area such as a wellhead protection zone. Within these zones the project would consist of electrified train track, a non-pollution-generating surface. The City of Federal Way places restrictions on the use and/or storage of petroleum products and other hazardous materials within wellhead protection zones.

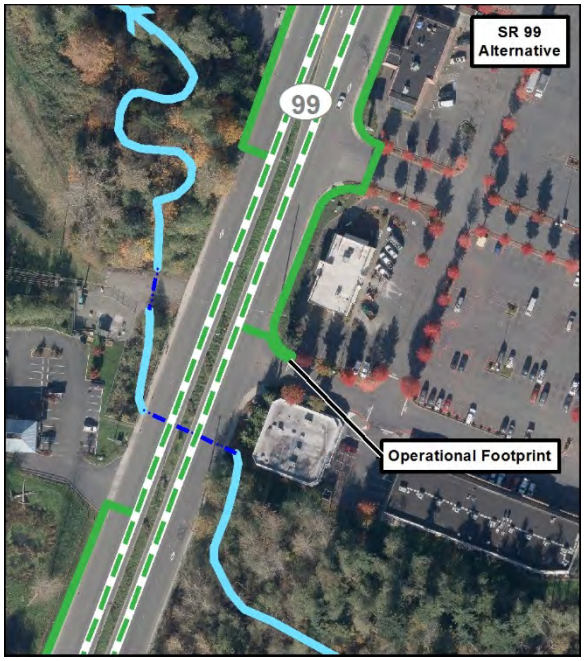
Sound Transit would consult with the City of SeaTac and Lakehaven Utility District during final design regarding proposed stormwater management measures within recharge zones to protect groundwater quality. No adverse impacts on groundwater are expected.

Impacts by Alternative

SR 99 Alternative

Surface Water

The SR 99 Alternative would be located in the median of SR 99 where the road intersects with McSorley Creek and Redondo Creek, and road improvements would not affect the culverts in these locations (see Exhibits 4.8-3 and 4.8-4 and Inset B1 to Exhibit 4.8-3, at right). Massey Creek begins west of SR 99 and therefore would not be affected by this alternative.

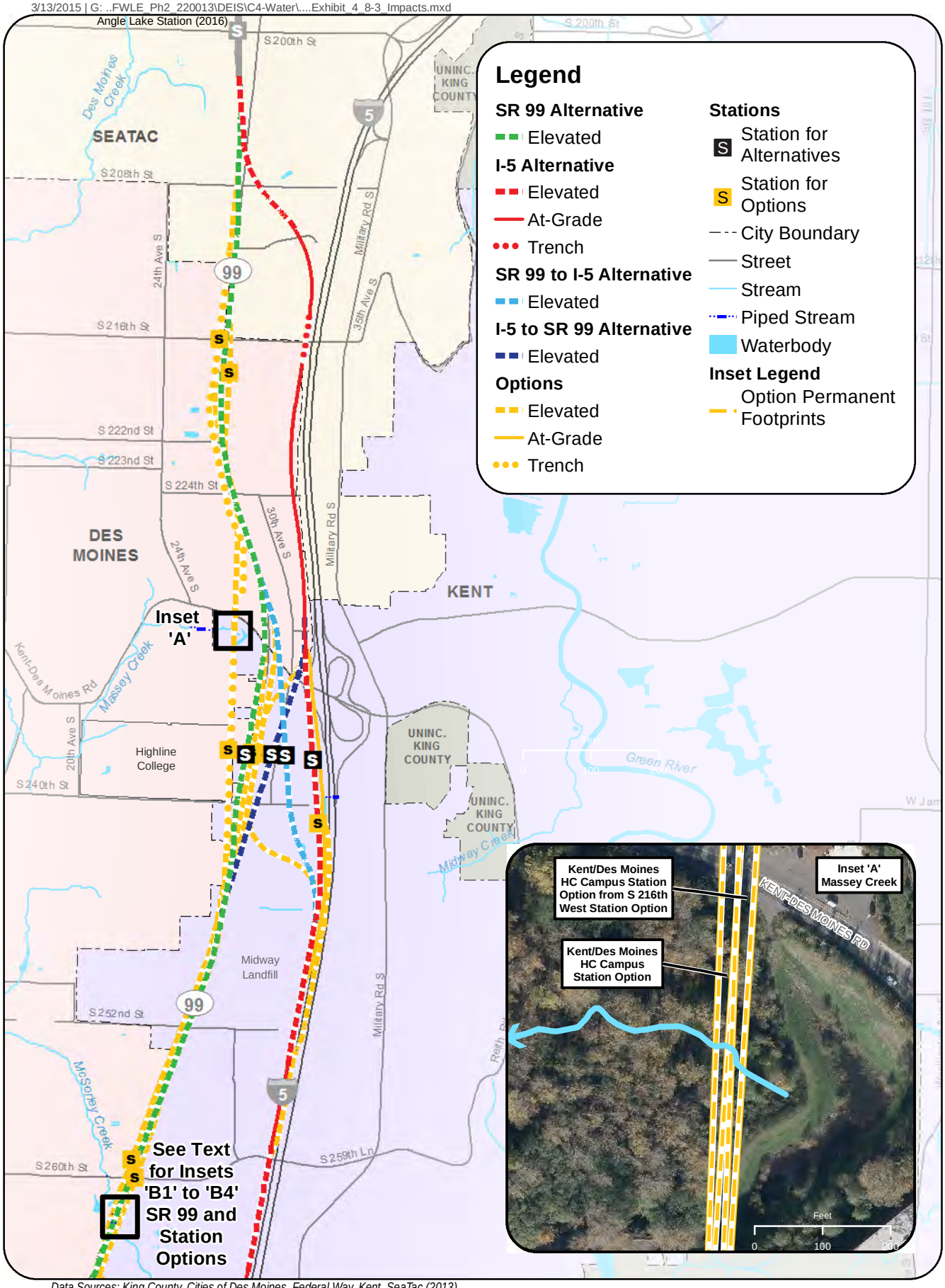


Inset B1 to Exhibit 4.8-3: SR 99 Alternative at McSorley Creek

Impervious Surface

The SR 99 Alternative and options would have a project guideway and road improvements footprint ranging from 92 to 135 acres.

Table 4.8-1 summarizes the range of impervious surface changes that would result from the different alternatives compared to existing conditions. Acreages of increase in PGIS and non-PGIS are shown in Table 4.8-3.



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.8-3
Stream Crossings (North)

Federal Way Link Extension

While the guideway would be exclusive and non-PGIS, PGIS would increase by about 10 acres due to the station park-and-rides and some road improvements along SR 99.

Groundwater

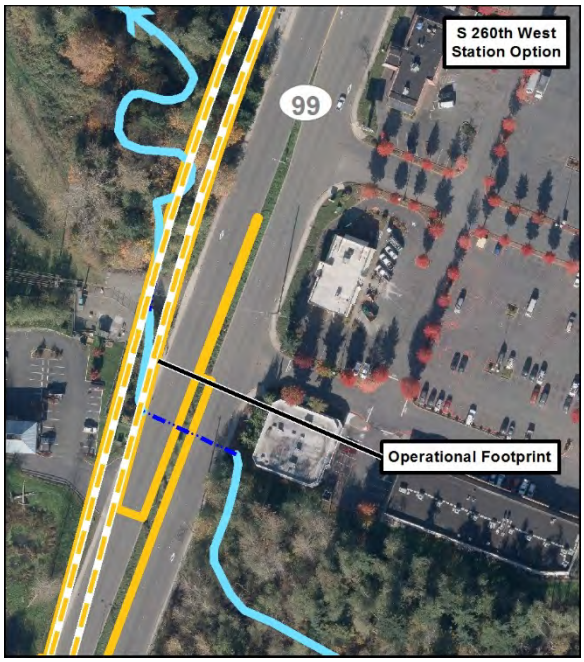
Approximately one-quarter mile of the SR 99 Alternative would be within the 10-year recharge zones for Lakehaven Utility District Wells #7 and 18, which are located immediately west of SR 99. The SR 99 station options would not change this impact.

SR 99 Station Options

Surface Water

The Kent/Des Moines HC Campus Station Option would cross the uppermost section of Massey Creek just west of SR 99 (Exhibit 4.8-3, Inset A). The creek channel lies approximately 200 feet south of the foot of the road embankment within a 600-foot-long, undeveloped, depressed area. The guideway associated with this option would fully span the creek and most if not all of its buffer and would not impact the stream**.**

Immediately west of SR 99, the South Fork of McSorley Creek flows west and then north for approximately 300 feet after exiting a culvert under SR 99. The S 260th West Station Option would span this creek on an elevated guideway on the west side of SR 99 and would not have any direct impacts (Exhibit 4.8-3, Inset B2). The S 260th East Station Option would cross McSorley Creek on the east side of SR 99 and would span the creek on an elevated guideway (Exhibit 4.8-3, Inset B3). No direct impacts to the creek would occur from this option, although there is potential for impacts on adjacent wetlands and/or wetland or stream buffers from the placement of guideway columns.



Inset B2 to Exhibit 4.8-3: S 260th West Station Option at McSorley Creek

The S 272nd Redondo Trench Station Option would have the same impacts to McSorley Creek as the S 260th East Station Option (Exhibit 4.8-3, Inset B4). This option would also travel along a utility access road that runs on the east side of the ravine carrying Redondo Creek north of Redondo Way S (Exhibit 4.8-4, Inset C).

A portion of this option would lie directly above the upper-most section of the creek for a length of 150 feet after it crosses under SR 99 from the east. The elevated guideway would fully span this section of the creek and no permanent adverse impacts would occur to Redondo Creek.

Impervious Surface

When compared to the SR 99 Alternative, the S 216th West Station Option would have the greatest increase in impervious surface, while the S 272nd Redondo Trench Station Option would have the least increase.

Groundwater

There would be no additional groundwater impacts with any of the SR 99 Station options.

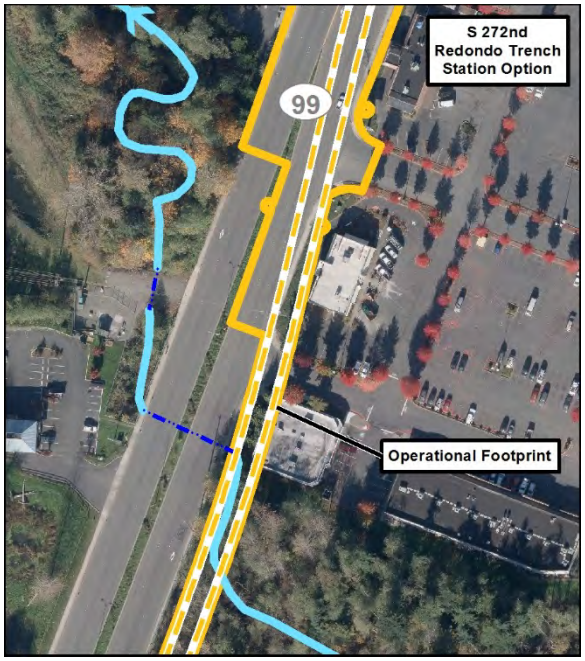
I-5 Alternative

Surface Water

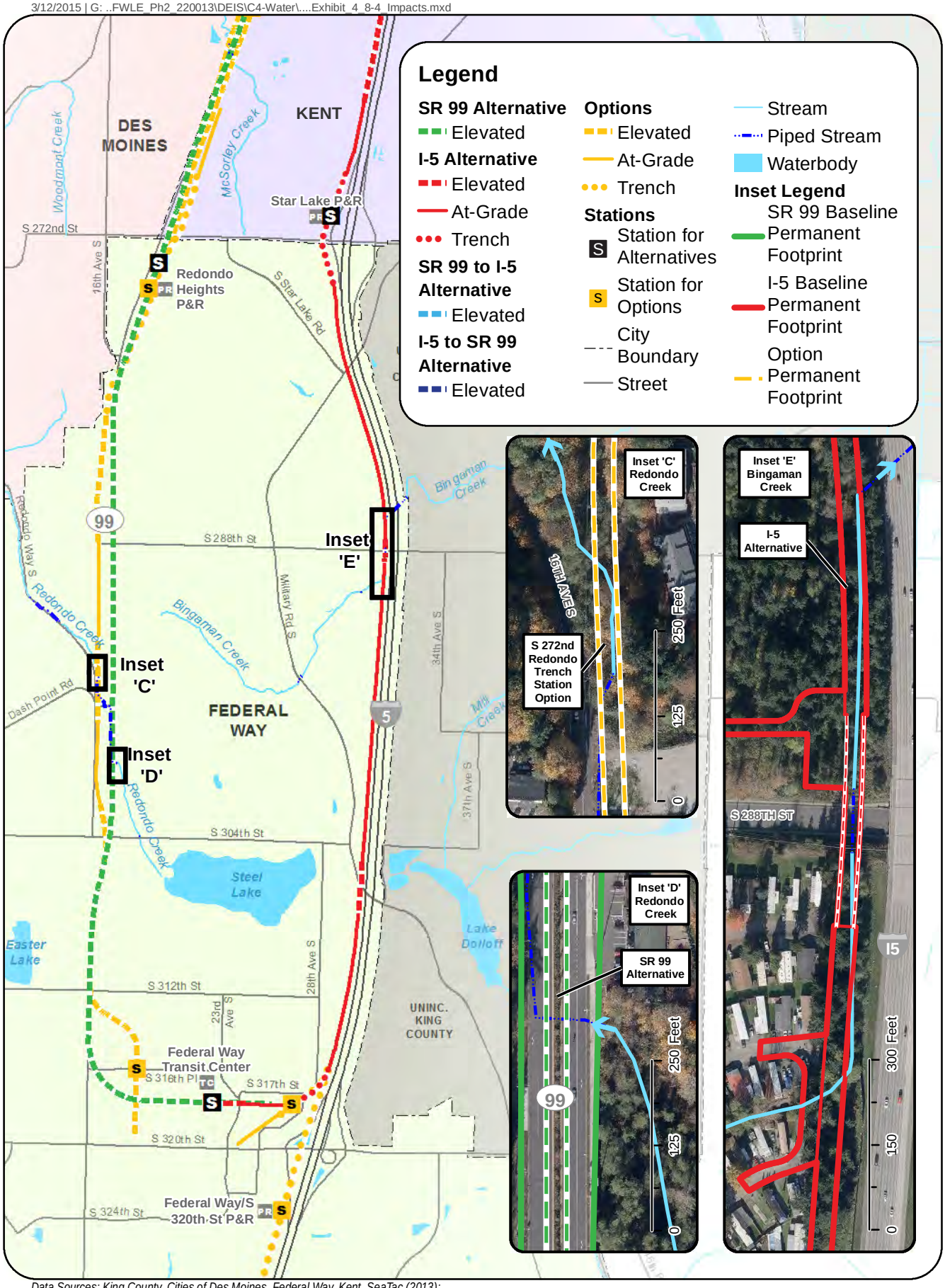
Bingaman Creek is a perennial stream that flows parallel to the west side of I-5 within the WSDOT right-of-way in the vicinity of S 288th Street (Exhibit 4.8-4, Inset E). The stream enters the right-of-way at the Camelot Square Mobile Home Park (approximately 450 feet south of S 288th Street). It then runs north along the western edge of the I-5 right-of-way, parallel to the freeway within a narrow (approximately 50-foot) band of forest lying between an I-5 sound wall and the mobile home park.

The creek crosses under S 288th Street and continues north along the I-5 right-of-way for approximately 600 feet before turning east under I-5 in a culvert. North of S 288th Street is a 300-foot-wide forested area that lies west of I-5; however, the creek continues to closely parallel the freeway in this area. The I-5 Alternative would be located directly over the creek both north and south of S 288th Street.

Inset B3 to Exhibit 4.8-3: S 260th East Station Option at McSorley Creek



Inset B4 to Exhibit 4.8-3: S 272nd Redondo Trench Station Option at McSorley Creek



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013);

N

0 0.25 0.5 1 Miles

EXHIBIT 4.8-4
Stream Crossings (South)

Federal Way Link Extension

Elevated guideway would support the track immediately north and south of S 288th Street. However, retained fill would cover the creek channel for approximately 410 feet north and 390 feet south of S 288th Street, eliminating a total of 800 feet of stream channel, and would require piping of the creek. Impacts on Bingaman Creek are discussed further in Section 4.9.4.2.

The alignment would impact an existing WSDOT stormwater pond located between S 259th and S 272nd Streets (refer to Appendix D4.8 Exhibit D4.8-1b). This would require the reconstruction or relocation of this pond.

Impervious Surface

The I-5 Alternative and options would have a project guideway and road improvements footprint ranging from 69 to 81 acres. As shown in Table 4.8-1, the I-5 Alternative would have the greatest impervious surface within the project footprint (140 percent) because much of the guideway would be constructed over currently pervious areas that currently lie adjacent to I-5.

Groundwater

A one-half-mile length of the I-5 Alternative lies within the 1- and 5-year recharge zones for Lakehaven Utility District Well 9, a short distance north of Steel Lake (refer to Exhibit 4.8-2). Potential impacts on groundwater from construction through the Midway Landfill are discussed in Section 4.12, Hazardous Materials, and Chapter 5, Construction.

I-5 Station and Alignment Options

Surface Water

There would be no additional surface water impacts with any of the I-5 station or alignment options.

Impervious Surface

The I-5 Alternative and options would all increase impervious surface. The I-5 options could have more or less impervious surface than the I-5 Alternative. The Federal Way I-5 Station Option would have the greatest increase in new impervious surface and the Kent/Des Moines SR 99 East Station Option would have the least increase in new impervious surface compared to the I-5 Alternative.

Groundwater

There would be no additional groundwater impacts with any of the I-5 station or alignment options. The Landfill Median Alignment

Option would avoid potential impacts on the Upper Gravel Aquifer and Southern Gravel Aquifer in the Midway Landfill.

SR 99 to I-5 Alternative

Surface Water

This alternative would have the same impacts to Bingaman Creek as the I-5 Alternative, discussed above.

Impervious Surface

The SR 99 to I-5 Alternative and options would have a project guideway and road improvements footprint ranging from 76 to 91 acres. Increases in impervious surface would range from 61 to 84 percent.

Groundwater

This alternative would be located within the 1- and 5-year recharge zones for Lakehaven Utility District Well 9 plus the two Highline Water District wellhead protection zones. Impacts would be the same as described for the SR 99 and I-5 alternatives.

I-5 to SR 99 Alternative

Surface Water

This alternative would have the same potential impacts on McSorley Creek as the SR 99 Alternative. Potential impacts from the S 260th West Station Option, the S 260th East Station Option, or the S 272nd Redondo Trench Station Option would be the same as described under the SR 99 Alternative Station Options.

Impervious Surface

The I-5 to SR 99 Alternative and options would have a project guideway and road improvements footprint ranging from 88 to 114 acres. Increases in impervious surface would range from 13 to 27 percent.

Groundwater

This alternative would also cross the same wellhead protection zones as discussed above under the SR 99 Alternative. Impacts would be the same as described for the SR 99 Alternative.

Indirect Impacts

Future population in Washington is expected to increase, which would likely increase vehicular traffic and put development pressure on many parts of the state. The proposed project could be expected to shift some future vehicle traffic to light rail and reduce vehicle-related stormwater pollutants. The project could also attract

residents and increase density in the urban areas, which could reduce development pressure and associated increases in stormwater runoff in undeveloped areas in other portions of the watershed. The project would also support redevelopment in the areas around the stations, which could lead to associated infrastructure improvements. Upgraded stormwater treatment in these redeveloped areas would improve water quality. Therefore, the proposed project could indirectly offset some adverse impacts on water resources caused by population increases.

4.8.5 Potential Mitigation Measures

The project would be designed to comply with all federal, state, and local regulations, which would control potential impacts to water resources through project planning, design, and the application of required BMPs (see Appendix D4.8). Measures to minimize long-term impacts include LID stormwater facilities; avoidance of the use of galvanized or copper roofs for project facilities; stormwater flow control using detention or filtration ponds or vaults, or dispersion; and water quality treatment using water quality ponds, bioretention, or media filter vaults. With these impacts controlled, as described in Section 4.8.3, the impacts on water resources are expected to be minor with the exception of the relocation of Bingaman Creek with the I-5 Alternative.

The only location requiring specific mitigation measures would be Bingaman Creek with the I-5 Alternative or the SR 99 to I-5 Alternative. North of S 288th Street, Bingaman Creek lies within a 300-foot-wide wooded area that is owned by King County Fire District #26. Relocating the creek to the west, away from footprint of the guideway and its associated columns, may be feasible in this location. If this approach is not feasible, at least 390 feet of the creek would need to be placed in a pipe. Offsite stream mitigation would be pursued to mitigate this adverse project impact. More information can be found in Section 4.9.5 (Ecosystems).

4.9 Ecosystems

4.9.1 Summary

Ecosystem resources within the FWLE corridor are limited and effects of the FWLE alternatives would be minor. The SR 99 Alternative and the I-5 to SR 99 Alternative would have the fewest impacts on wetlands and associated buffers, and would avoid impacts on streams, although station and alignment options would increase these impacts. The I-5 Alternative and SR 99 to I-5 Alternative would have greater impacts on wetlands and associated buffers, and would directly impact one stream, Bingaman Creek. The I-5 Alternative would result in the greatest loss of vegetation and habitat due to clearing of forested areas along the west side of I-5. Table 4.9-1 summarizes the permanent impacts by alternative on wetlands, buffers, streams and vegetation. Temporary, construction-period impacts are addressed in Chapter 5.

TABLE 4.9-1
Summary of Ecosystem Impacts

Alternative	Acres of Wetlands Impacted (Range with Options)[a]	Acres of Wetland Buffer Impacted (Range with Options)	Acres/Linear Feet of Streams Impacted (Range with Options)	Acres of Stream Buffer Impacted (Range with Options)	Acres of Vegetation Impacted (Range with Options)
SR 99 Alternative	**<0.1** (< 0.1-0.7)	**0.2** (0.2-0.8)	**0** (0-0)/ **0** (0-0)	**<0.1** (<0.1-0.5)	**3.5** (1.6-7.6)
I-5 Alternative	**1.1** (0.5 – 1.2)	**1.1** (0.9-2.3)	**0.2** (0.2-0.2)/ **1,055** (1,055 to 1,055)	**2.4** (2.4-2.4)	**35.4** (31.2-37.1)
SR 99 to I-5 Alternative	**0.5** (0.5-1.2)	**0.9** (0.9-1.1)	**0.2** (0.2-0.2)/ **1,055** (1,055 to 1,055)	**2.4** (2.4-2.4)	**29.1** (28.5-31.2)
I-5 to SR 99 Alternative	**<0.1** (<0.1-0.0.5)	**0.3** (0.3-0.7)	**0** (0-0)/ **0** (0-0)	**<0.1** (<0.1-0.5)	**5.1** (4.7-8.8)

Note: The ranges provided show the potential range of impacts when each alternative is combined with one or more of its station or alignment options.
[a] To provide a conservative estimate of wetland impacts, the impact analyses for all alternatives and options assumed a "worst-case" footprint for the long term that would remove all of the wetland and buffer within the footprint of the alternative or option.

4.9.2 Introduction to Resources and Regulatory Requirements

An ecosystem is the complex of a community of organisms and its environment functioning as an ecological unit (Merriam Webster Dictionary, 2013). Ecosystems are composed of many living organisms and the environment they inhabit. For the purposes of the Draft EIS,

Sound Transit identified ecosystem components in the study area as wetlands, streams, and vegetation that would support fish and wildlife, including threatened and endangered species. All impacts are described using these ecosystem components.

Wetlands, streams, and fish and wildlife species and their habitats within the FWLE corridor are protected by federal, state, and local regulations, which govern planning, land use, and management activities that may affect such resources.

These regulations, as well as applicable guidance from federal, state, and local agencies, were considered as part of this analysis because they must be addressed later in permitting phases of the project, or because they prescribe certain procedures that must be followed during the preparation of the EIS. The Ecosystems Technical Report, Appendix G2, provides detailed information on the regulations, analysis methods, affected environment, species, and impacts discussed in this section.

4.9.3 Affected Environment

The study area for wetlands, streams, and wildlife habitat was measured from each side of the permanent, operational footprint for each alternative or option, as follows:

- Wetlands: 300 feet
- Streams: 100 feet upstream and 300 feet downstream of crossings
- Vegetation and wildlife habitat: 200 feet

The evaluation of ecosystem components was based on literature reviews; consultation with federal, state, and local agencies and their websites; field work; and review of aerial mapping. Field assessments of wetlands and stream crossings intersected by the operational and construction footprints of the FWLE alternatives were also conducted to provide existing conditions for impacts analysis. The ecosystem components were assessed by applying classification systems specific to the resource. The following subsections describe the ecosystems found in the study areas. Wetlands, streams, and vegetation descriptions are presented for the general SR 99 and I-5 corridors. Descriptions of wildlife habitat and potential occurrence of federally and state-listed fish and wildlife species are presented in a single discussion for both corridors due to the similarity of the habitat and potential species occurrence in the corridors.

4.9.3.1 Wetlands

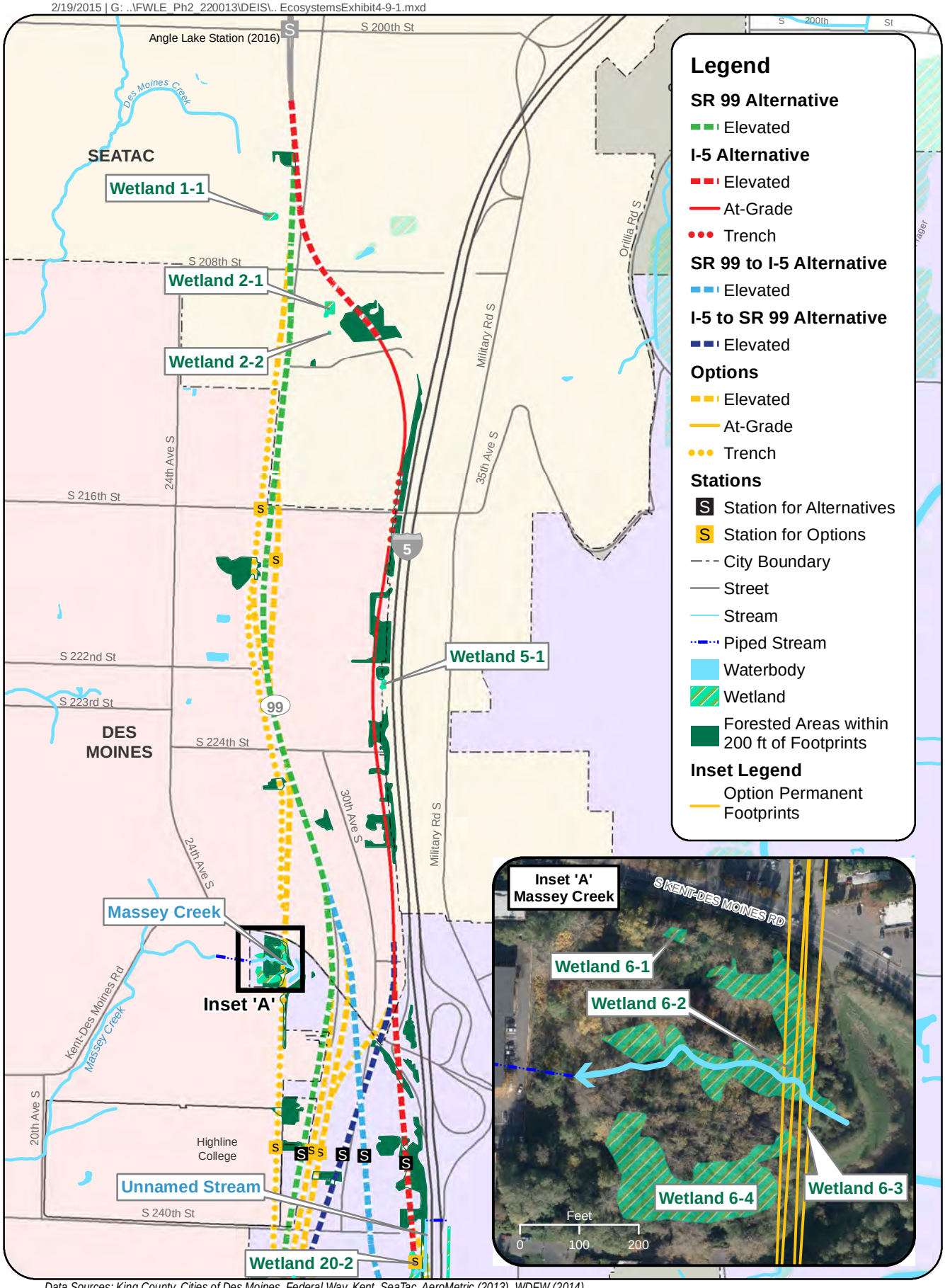
The FWLE corridor is located on the broad, flat terrace between Puget Sound and the Green River Valley. The plateau includes landforms such as depressions, slope and seep areas, and stream valleys that may support wetlands. The wetlands now present in the area may represent fragments of larger historical wetland systems, or they may be recently formed wetlands that have developed as a result of changes in land use and surface water drainage patterns over the last 50 years of development in the corridor. Details for each of the wetlands within the study area are provided in the Ecosystems Technical Report (Appendix G2), and the wetlands are shown on Exhibits 4.9-1 through 4.9-4.

SR 99 Corridor

Seventeen wetlands were identified within the SR 99 Alternative study area. The identified wetlands vary in overall size from less than 0.1 acre to more than 108 acres. The McSorley Creek Wetland (Wetland 12-1) is the largest undisturbed wetland in the FWLE corridor, and forms the headwaters of McSorley Creek. Wetlands in the study area are primarily deciduous forested wetlands dominated by red alder, although the vegetation cover in wetlands immediately adjoining SR 99 is disturbed and dominated by invasive species. The Massey Creek wetlands (Wetlands 6-1 through 6-4) are located on undeveloped parcels and are less disturbed than other smaller wetlands in the study area.

I-5 Corridor

Sixteen wetlands were identified within the I-5 Alternative study area. The identified wetlands vary in size from less than 0.1 acre to over 108 acres (McSorley Creek Wetland [12-1]). Other wetlands in the I-5 Alternative study area are generally small, isolated features. Wetlands in the I-5 corridor are primarily deciduous forested wetlands dominated by red alder trees. Scrub-shrub and emergent wetlands, less common in the I-5 corridor, are predominantly vegetated with willows and reed canary grass.

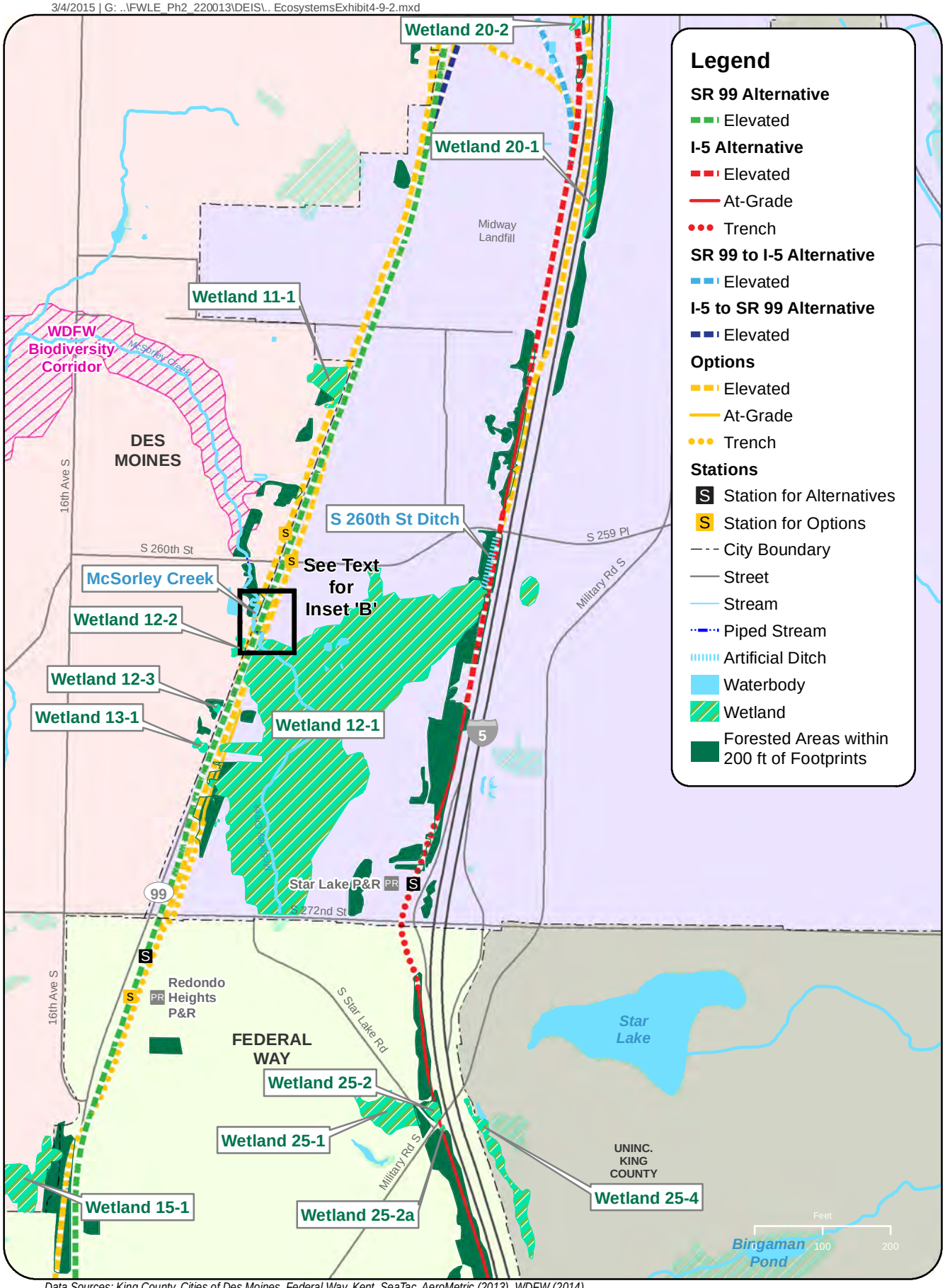


Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013). WDFW (2014).

N

0 0.25 0.5 Miles

EXHIBIT 4.9-1
Ecosystems Resources
Angle Lake Station to Kent/Des Moines Station
Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013). WDFW (2014).

N

0 0.25 0.5 Miles

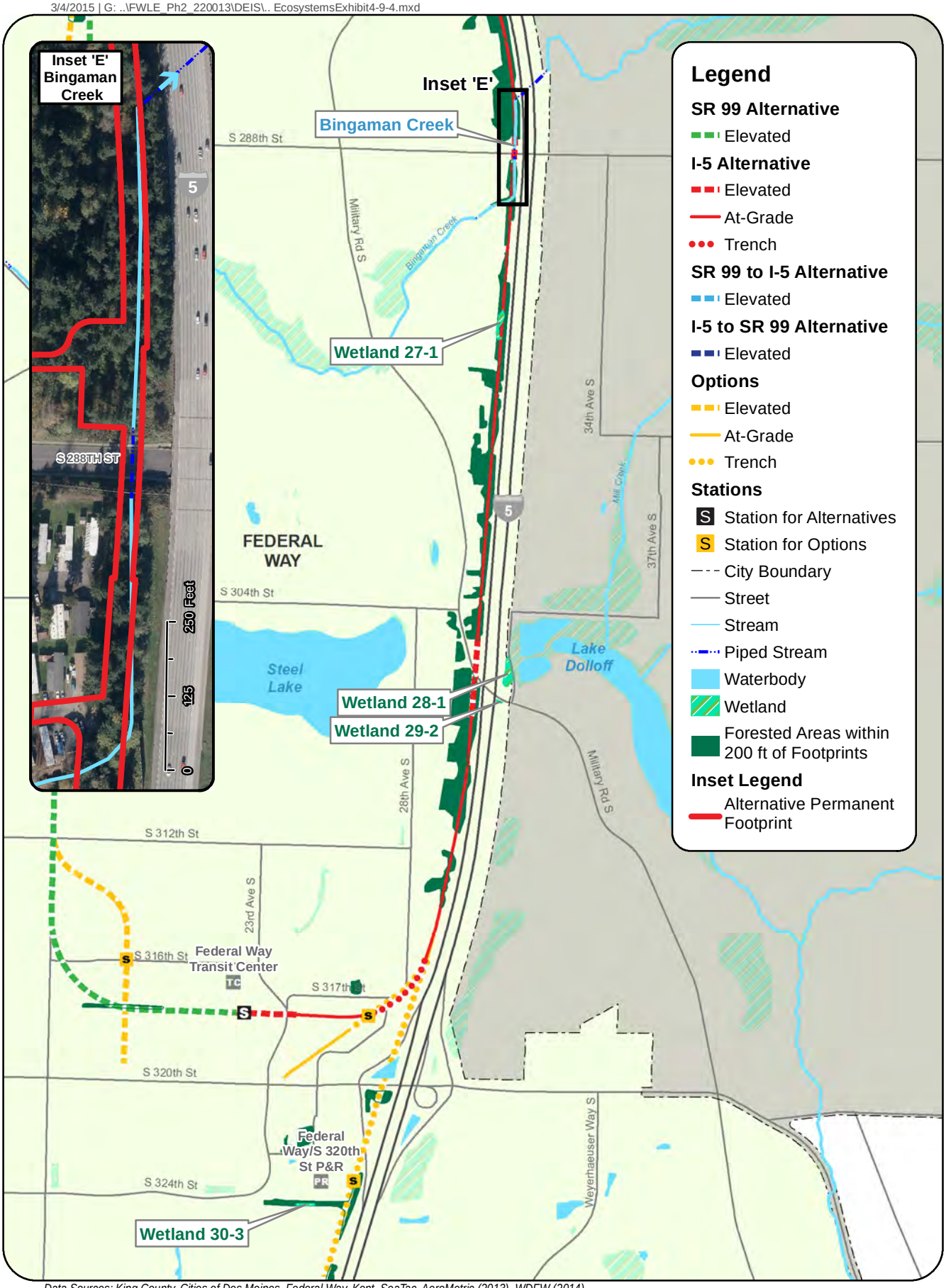
EXHIBIT 4.9-2
Ecosystems Resources
Kent/Des Moines Station to S 272nd Station
Federal Way Link Extension

Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013). WDFW (2014).

N

0 0.25 0.5 Miles

EXHIBIT 4.9-3
Ecosystems Resources
S 288th to Federal Way Transit Center Station - SR 99 Alternative
Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, AeroMetric (2013). WDFW (2014).

N

0 0.25 0.5 Miles

EXHIBIT 4.9-4
Ecosystems Resources
S 288th to Federal Way Transit Center Station - I-5 Alternative
Federal Way Link Extension

4.9.3.2 Streams and Aquatic Habitat

Four named streams, one unnamed stream, and a drainage ditch intersect the FWLE alternatives. There is limited biological information available on the small creeks that intersect the study area (described below by corridor). In general, these are low-gradient streams typical of Puget Sound lowland drainages that receive their flow from springs, seeps, lake outlets, rainfall, and groundwater runoff. All of these creeks have undergone the types of habitat degradation associated with development and urbanization. Streams in the FWLE corridor are listed in Table 4.9-2 and shown on Exhibits 4.9-1 through 4.9-4. Stream type terminology varies between jurisdictions, but all are based on the size of the stream and its ability to support fish.

Aquatic habitat surveys were conducted 300 feet downstream and 100 feet upstream of each stream crossing, and on the entire stretch of any stream paralleling the project within 200 feet from the edge of the alternative, where access allowed. The width of the riparian area alongside the streams observed in the field was typically restricted to within 50 feet or less of the stream and determined by the edges of roadways and development, as well as by rights-of-way access and property boundaries. Aquatic habitat conditions and functional status were evaluated based on fish life histories, spawning and rearing habitat requirements, seasonal use and field observations. Habitat was assessed with the assumption that anadromous fish might one day be able to access the area even if they cannot under present conditions. To the extent information is currently available or could be ascertained in the field, downstream fish passage obstructions, including types of impediments to fish passage, were also identified for each stream reach.

SR 99 Corridor

Three streams intersect the SR 99 study area and are described in Section 4.8, Water Resources. Within the study area, Massey Creek originates from a stormwater pond and flows west through a forested depressional area wetland for approximately 500 feet (Exhibit 4.9-1). The stream channel is very shallow and poorly defined with some standing water and side channels through the wetland. A vertical drain and culvert downstream serves as a complete barrier to fish passage and no fish are present in this reach.

TABLE 4.9-2
Streams in the Federal Way Link Extension Study Area

Stream Name	Corridor	Stream Type per City Code[a]	Jurisdiction	Local Jurisdiction Stream Buffer Width	Stream Type per WAC 222-16-031[b]	Documented Salmonid Presence in Study Area
Massey Creek	SR 99	Type 3	Kent	40 feet	Type 3	No
McSorley Creek (west of SR 99)	SR 99	Type F	Des Moines	115 feet	Type 3	No
McSorley Creek (east of SR 99)	SR 99	Type 3	Kent	40 feet	Type 3	No
Redondo Creek (downstream of Dash Point Road)	SR 99	Major Stream	Federal Way	115 feet	Type 3	No
Redondo Creek (east side of SR 99)	SR 99	Minor Stream	Federal Way	65 feet	Type 5	No
Bingaman Creek	I-5	Major Stream	Federal Way	115 feet	Type 3	No
Unnamed stream in I-5 right-of-way (north of S 240th Street)	I-5	Type 3	Kent	40 feet	Type 5	No
S 260th Street Ditch[c]	I-5	n/a	Kent	n/a	n/a	No

[a] Type 3 streams are segments of natural waters within bankfull width of defined channels that are perennial or intermittent streams within the portion of the channel where there is no documented salmonid use. Type F streams are those that are salmonid-bearing or (as is the case here) have the potential to support salmonids. Major streams are streams that contain or support resident or migratory fish. Minor streams are any streams that do not meet the definition of "major stream."

[b] Stream classifications according to WAC 222-16-031 are provisionally based on definitions where fish use has not been determined. Upon FWLE alternative selection and final EIS preparation, these stream type determinations may change as a result of more detailed surveys.

[c] The City of Kent does not regulate activities in artificial drainages intentionally created from nonwetland sites, including, but not limited to, grass-lined swales, irrigation and drainage ditches, retention or detention facilities, and landscape features (Kent City Code 11.06.040)

McSorley Creek flows northwest out of a large wetland area east of SR 99 (Exhibit 4.9-2). The stream channel within the wetland contains good habitat conditions for fish, and is somewhat isolated from the surrounding urban developed areas by a large riparian area of mixed forest. Cutthroat trout and coho salmon have been documented in McSorley Creek from the mouth at Puget Sound upstream to at least 16th Avenue S (Washington Department of Fish and Wildlife [WDFW], 2014a, b). The culvert under SR 99 is listed as a partial barrier to fish passage (WDFW, 2014a). The reach of McSorley Creek in the project corridor is mapped as non-fish-bearing (Washington Department of Natural Resources [WDNR], 2014). However, observations during field visits indicate that although this reach is isolated from McSorley Creek where fish are known to be present, the reach contains habitat that has the potential to support fish (see Appendix G2). The stream

channel has a predominantly gravel substrate with vegetated banks including tree cover for shading and large woody debris recruitment, and is low-gradient with a variety of riffle and run habitat.

Redondo Creek originates at Steel Lake and passes under S 304th Street and through a wetland on the east side of SR 99, after which it is conveyed within the stormwater system under SR 99 before emerging from a culvert near the intersection of SR 99 and Dash Point Road (Exhibit 4.9-3). From this crossing, Redondo Creek flows northwest for approximately 1 mile to Puget Sound. Coho salmon are documented as present downstream of S 291st Place to Puget Sound (WDFW, 2014a; StreamNet, 2014). Redondo Creek passes through several pipe systems and its confluence with Puget Sound is also from within a pipe. Approximately 750 feet downstream of the culvert under SR 99 and Dash Point Road, the creek enters a vertical drain structure that poses a complete passage barrier to fish moving upstream into the study area.

I-5 Corridor

Bingaman Creek enters the I-5 study area from a mobile home park approximately 500 feet south of S 288th Street, and then runs north along the western edge of the I-5 right-of-way. It crosses under S 288th Street and continues north along the I-5 right-of-way for approximately 600 feet where it enters a culvert under I-5. The creek continues eastward of I-5, where it eventually connects to Bingaman Pond in the Green River watershed. Due to its habitat features and connection to Bingaman Pond, the reach in the study area has the potential to support fish, although this reach is likely dry during part of the year (Appendix G2). Cutthroat trout are potentially present in Bingaman Creek, including the study area west of I-5 (WDFW, 2014b). Despite the stream being perennial, the habitat in the reach north of S 288th street could potentially support cutthroat trout that may move in and out of the reach during periods of flow. WDFW Salmonscape (2014a) and Kerwin and Nelson (2000) also report Bingaman Creek as having the potential to support coho salmon if barriers downstream of Bingaman Pond connecting to Mill Creek were not present. Potential fish presence is based on available habitat, and other species such as sculpins may also be present, but fish species actually currently inhabiting Bingaman Creek are undocumented (Fisher, pers. comm. 2014).

There is a small unnamed stream channel that originates in Wetland 20-2 on the west side of I-5 just south of the Kent-Des Moines Road (Exhibit 4.9-4). This small channel flows north alongside I-5 for approximately 600 feet, then through a culvert under I-5. The channel is low-gradient and the bed is comprised of a thick layer of silt and organic material. The east bank is artificially created from the highway embankment materials and has been cleared of vegetation. This channel does not provide suitable habitat for salmonids or other fish species and is isolated from streams that are known to contain fish.

The only other surface water channel that intersects the I-5 study area is a drainage ditch south of 260th Street along a gravel road bed beside the I-5 embankment (Exhibit 4.9-2). This is a riprap-lined artificial channel that conveys water from a culvert under S 260th Street to the northern portion of the McSorley Creek Wetland area. This channel does not provide suitable habitat for fish and is not connected to any fish-inhabitable waters.

4.9.3.3 Vegetation

The FWLE corridor is within the western hemlock (*Tsuga heterophylla*) forest zone (Franklin and Dyrness, 1988). Western hemlock and western red cedar (*Thuja plicata*) are the dominant forest species in this zone, although Douglas fir (*Pseudotsuga menziesii*) is also very common. Deciduous species occur primarily in disturbed areas and along rivers and streams. Forested areas within 200 feet of the project footprint are shown on Exhibits 4.9-1 through 4.9-4.

SR 99 Corridor

Due to the heavily developed nature of the project corridor, most of the vegetation present in the SR 99 study area reflects landscaping practices for urban and suburban areas, with remnant tree canopy retained for shade or aesthetics. Within the maintained road rights-of-way, the vegetation includes a mixture of trees, native and non-native shrubs, landscaped areas, mowed grasses, and invasive weeds. Several notable areas of upland vegetation are present within the 400-foot-wide study area. The majority of these areas consist of mixed deciduous and coniferous forest with a disturbed understory (not a native upland classification). The largest remnant of native upland forest in the study area is located in the McSorley Creek riparian corridor to the west of SR 99.

I-5 Corridor

The undeveloped areas west of I-5 and the I-5 right-of-way are predominantly vegetated by non-native species with limited habitat value. The I-5 median is maintained clear of trees and the vegetation consists of mowed areas with mixed domestic and invasive grass species and weeds, and small patches of non-native shrubs. Three larger patches of contiguous forest cover were identified along the west side of I-5: one extending from Military Road/Star Lake Road to S 288th Street; one extending from approximately S 292nd Street to S 301st Street; and one extending from Military Road near S 304th Street to approximately S 311th Street. The forest patch located north of S 288th Street is dominated by native species, while the remaining forest patches are predominantly non-native.

4.9.3.4 Wildlife Habitat

The SR 99 and I-5 corridors are located within a mapped medium-density urban habitat zone, having 30 to 59 percent impervious surface (Chappell et al., 2001). Wetland and riparian areas can support reptiles and amphibians such as garter snakes and frogs. These areas also can support small mammal species and possibly some larger mammal species such as deer and coyote. The FWLE corridor lies within the Pacific Flyway, a migratory bird corridor consisting of the western coastal areas of North, Central, and South America. Wetlands, lakes, and forested areas in the project vicinity could serve as foraging, resting, or nesting grounds for migratory and resident bird species. The McSorley Creek Wetland area between SR 99 and I-5 has the largest tract of forested habitat along the FWLE corridor. The vegetated tracts along the McSorley Creek riparian corridor, which continue to the west of the study area through Saltwater State Park and out to the Puget Sound shoreline, also provide one of the few potential wildlife movement corridors in the area.

4.9.3.5 Threatened and Endangered Fish and Wildlife Species, Species of Concern, Essential Fish Habitat, and WDFW Priority Species

There is no Endangered Species Act (ESA) designated critical habitat in the FWLE corridor, and no listed fish species or federal species of concern are known to be present (WDFW 2014a,b; StreamNet, 2014; Kerwin and Nelson, 2000). The Magnuson-Stevens Fishery Conservation and Management Act protects essential fish habitat (EFH) for federally managed species of Pacific salmon, specifically

Chinook (*Oncorhynchus tshawytscha*), pink (*Oncorhynchus gorbuscha*), and coho salmon (*Oncorhynchus kisutch*). These species are not present within the study area; however, EFH also includes historic distribution and waters formerly accessible to salmon. Coho were likely present in Redondo, Bingaman, and McSorley creeks within the study area prior to development, and consequently these water bodies are included in EFH. Coho salmon, a federal species of concern, is known to currently inhabit the lower reaches of McSorley Creek downstream of passage barriers outside of the study area. The Oregon spotted frog (*Rana pretiosa*), a federally threatened species, historically occurred in the Green River at Kent; there are no current populations of Oregon spotted frog known to occur in the study area. The western toad (*Bufo boreas*) is a state candidate and federal species of concern that is found in Lake Washington and other water bodies in the area, but is unlikely to occur within most of the study area. The McSorley Creek Wetland may provide suitable habitat for western toads, but is unlikely to provide suitable habitat for Oregon spotted frogs since the wetland lacks extensive emergent habitat with good sun exposure that would be suitable for egg-laying, and it is located in a highly urbanized watershed. WDFW has also identified the McSorley Creek riparian corridor west of SR 99 as a Biodiversity Corridor, which is a WDFW priority habitat area.

4.9.4 Environmental Impacts

4.9.4.1 No Build Alternative

Under the No Build Alternative, the FWLE would not be constructed. The existing wetlands, streams, vegetation and wildlife habitat would not be directly or indirectly affected by the No Build Alternative. The potential environmental benefits of the FWLE would also not be realized under the No Build Alternative, including implementation of proposed mitigation for wetlands, streams, and regulatory buffers, which could improve the existing conditions of these resources; and opportunities to concentrate growth in urbanized areas instead of less-developed, rural areas where high-value habitat and wetlands are more prevalent.

4.9.4.2 Build Alternatives

The following subsections describe the direct and indirect impacts of the build alternatives. Construction impacts related to ecosystems are discussed in Chapter 5.

Direct Impacts

Potential operational impacts on wetlands and streams were initially assessed using GIS to overlay alternative FWLE footprints on a map of ecosystem resources. Potential operational impacts on wildlife and vegetation were assessed using GIS and existing vegetation cover layers to calculate the amount of undeveloped vegetated areas potentially affected by the FWLE alternatives.

To provide a conservative estimate of wetland impacts, the impact analysis completed for all alternatives and options assumed a "worst-case" at-grade footprint for the long term. No direct long-term impacts are anticipated outside of the "worst-case" at-grade footprint. However, based on factors such as the width and height of elevated guideways, some of the areas may not experience long-term impacts. Although elevated guideways would not permanently fill all wetlands within the permanent footprint, actual impacts would be mostly limited to shading under the guideway. During the Final EIS and/or the permitting phase, Sound Transit would reevaluate these assumptions to provide a more detailed assessment of long-term impacts and identify detailed temporary construction limits to distinguish which resources could be restored following construction.

In addition to the permanent physical footprint of the alternatives, vegetation would need to be maintained within 15 feet of the edge of the guideway to prevent debris from falling onto the guideway. This area is maintained and allows for grass and shrubs but not large trees. The loss of forest cover is considered a long-term impact on wildlife habitat because the type of vegetation and associated habitat would change in this zone. This area is considered a temporary impact on wetlands, streams, and their associated buffers because grass and/or shrub vegetation would be re-established following construction, which would provide wetland or stream buffer functions. This approach avoids counting permanent impacts in the same area twice.

Exhibits 4.9-1 through 4.9-4 show locations of potential impacts of the build alternatives and options on streams, vegetation, wildlife, and wetlands. Table 4.9-1 summarizes these impacts, which are described by alternative. Station or alignment options are described or quantified as an increase or decrease relative to the alternative(s) they are associated with.

Wetlands

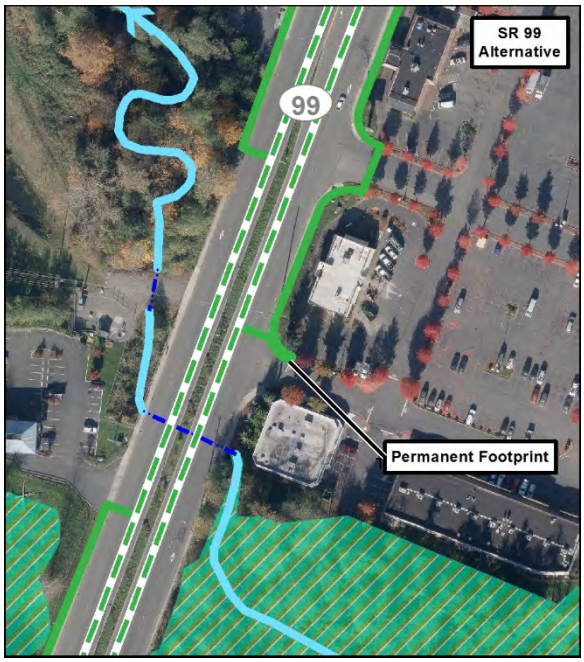
Wetlands Impacts Common to All Alternatives

The build alternatives would have direct, long-term impacts on wetlands and wetland buffers. Filling or excavating within wetlands for column placement, at-grade guideways, and retaining walls would result in loss of wetland area or loss of wetland function through changes to surface or subsurface water flows or permanent changes to vegetation. Along elevated profiles, grading and filling to install support columns and bridge support structures would result in long-term loss of wetland and wetland buffer area. Although elevated structures result in less fill-related impacts, they can potentially result in impacts from shading. Impacts can occur from shading as shading would affect the type of vegetation that could be established in these areas. At-grade and trench profiles would result in long-term loss of wetland and buffer acreage due to placing fill material in wetlands, excavating wetlands, or grading activities for new at-grade or trench guideways, stations, retaining and sound walls, and stormwater facilities. Grading and filling of wetlands can permanently change the capacity of a wetland to perform particular functions such as storing stormwater, filtering pollutants, protecting stream banks and providing habitat for wildlife. Elevated alignments would result in a smaller long-term footprint, allowing for retention of more wetland area and regeneration of vegetation under elevated structures, whereas at-grade alignments would permanently convert wetlands to a developed condition.

Wetlands Impacts by Alternative

SR 99 Alternative

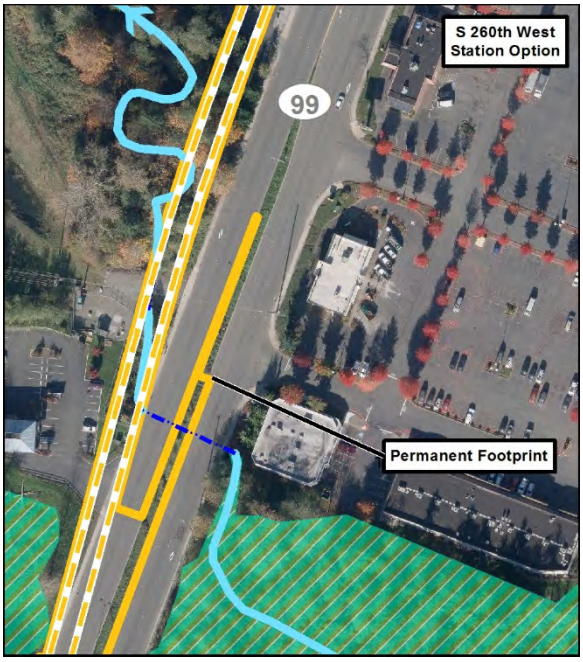
The SR 99 Alternative would be elevated, with the exception of some station options that include trenches, and would have impacts on less than 0.1 acre of wetland and 0.2 acre of wetland buffer. Although elevated structures can minimize the amount of permanent ground disturbance, the amount of sunlight available to the vegetation underneath may be reduced, resulting in shade-related impacts. Elevated guideway structures would be approximately 40 feet wide and more than 15 feet above the ground surface in most places; thus,



Inset B1 to Exhibit 4.9-2: SR 99 Alternative at McSorley Creek

shading and other impacts on vegetation would likely be minimal.

The SR 99 Alternative would result in less than 0.1 acre of long-term impacts on wetlands and 0.2 acre of long-term impacts on wetland buffers. This alternative could have up to 0.6 acre of additional wetland impact and 0.6 acre of additional wetland buffer impact if the Kent/Des Moines HC Campus Station Option, the S 260th East Station Option, and the S 272nd Redondo Trench Station Option were all selected. A segment of the S 272nd Redondo Trench Station Option would require trenching within a small portion of the McSorley Creek Wetland that adjoins the east side of SR 99.

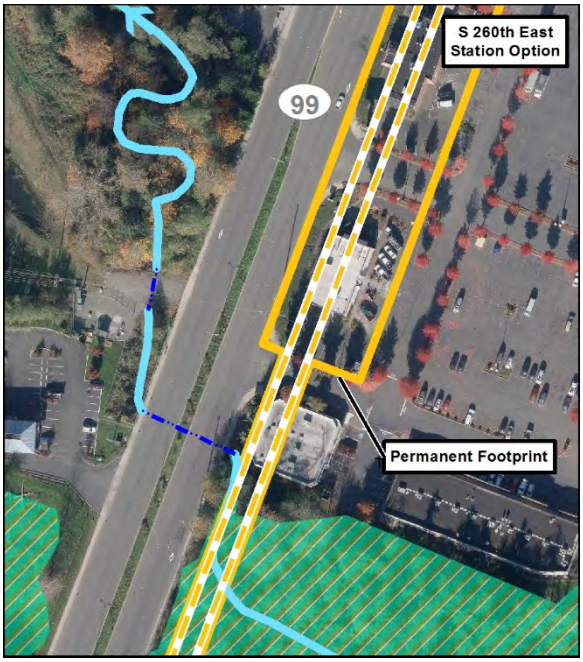


Inset B2 to Exhibit 4.9-2: S 260th West Station Option at McSorley Creek

I-5 Alternative

The I-5 Alternative would primarily be at-grade, which would permanently convert existing vegetated land and wetlands to a developed condition within the area of the project footprint.

The I-5 Alternative would result in a total of 1.1 acres of long-term impacts on wetlands, and 1.1 acres of long-term impacts on wetland buffers. This alternative could have up to 0.1 acre of additional wetland impact and 1.2 acres of additional wetland buffer impact if the Kent/Des Moines At-Grade Station Option and the Federal Way S 320th Park-and-Ride Station Option were both selected.



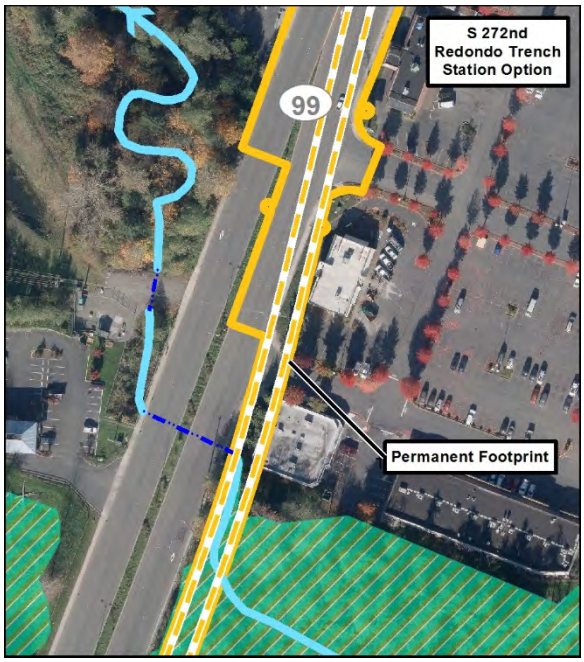
Inset B3 to Exhibit 4.9-2: S 260th East Station Option at McSorley Creek

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative would result in a total of 0.5 acre of long-term impacts on wetlands and 0.9 acre of long-term impacts on wetland buffers. It could have up to 0.7 acre of additional wetland impact and 0.2 acres of additional wetland buffer impact if the Federal Way S 320th Park-and-Ride Station Option were selected.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would result in less than 0.1 acre of long-term impacts on wetlands, and 0.3 acre of long-term impacts on wetland buffers. It could have up to 0.4 acre of additional wetland and wetland buffer impact if the S 260th East Station Option and S 272nd Redondo Trench Station Option were selected.



Inset B4 to Exhibit 4.9-2: S 272nd Redondo Trench Station Option at McSorley Creek

Streams and Aquatic Habitat

Impacts on streams could occur when alternatives either cross a stream or are parallel to a stream. Details of each stream impact are described below by alternative.

Stream and Aquatic Habitat Impacts by Alternative

SR 99 Alternative

Where the SR 99 Alternative would cross a stream channel, the structure would span the stream with the guideway columns on either side beyond the stream banks. This configuration would have little to no direct effect on in-stream habitat, with some effects on the surrounding riparian areas if trees and vegetation were lost. After construction, these areas could be replanted with native vegetation, and could result in habitat improvement. However, the presence of an elevated guideway near streams could preclude forest habitat development in those areas, reducing the potential for the recruitment of large woody material to adjacent streams. Shading from the structure may provide overhead cover and temperature regulation otherwise lost from removal of mature riparian vegetation. Additional noise and human activity associated with the operation of the FWLE would have minimal impacts on fish species since the study area streams are within highly urbanized environments.

The SR 99 Alternative would cross three streams, with no impacts on the Massey Creek stream buffer, less than 0.1 acre on the McSorley Creek stream buffer, and less than 0.1 acre on the Redondo Creek stream buffer. There would be no impacts on the stream channels themselves because all three channels are in culverts under SR 99 (Table 4.9-3). This impact could increase to 0.7 acre of stream buffer impact if the Kent/Des Moines HC Campus Station Option, the S 260th West Station Option, and the S 272nd Redondo Trench Station

Option were all chosen. All station and alignment options would continue to span the three creeks in the SR 99 study area and would avoid long-term impacts on the creeks.

I-5 Alternative

The I-5 Alternative would be located on the west side of I-5 and would be within WSDOT right-of-way south of Kent-Des Moines Road. Where streams are parallel to the I-5 Alternative, multiple columns would need to be placed within or in proximity to the stream channel for the distance where they are parallel, and impacts on the stream would consequently be more pronounced. Portions of the stream could be rerouted to avoid the columns, or column placement could be adjusted in order to span as much of the existing stream channel as possible.

The small unnamed stream south of Kent-Des Moines Road would not be affected beyond a small portion of the buffer for this stream, amounting to less than 0.1 acre. This small channel contains poor habitat and is not known to be inhabited by fish; none were observed during the field visit. Any impacts would occur outside the stream channel, and consequently there would be no effects on fish. An artificial drainage ditch on the north side of the McSorley Creek Wetland lies parallel to the I-5 corridor, but would not be directly impacted.

North of S 288th Street, Bingaman Creek flows north parallel to and west of I-5 within a wooded area approximately 300 feet wide (see Exhibit 4.9-4). The creek would be located directly under the I-5 Alternative, resulting in long-term impacts on 0.2 acre of the existing stream channel and 2.4 acres of the riparian forest buffer along this reach. Elevated guideways and columns placed alongside a stream channel would have impacts on the riparian vegetation and bank characteristics that would reduce large woody debris (LWD) and nutrient inputs and vegetative cover to the stream bank and channel.

On the north side of S 288th Street there is undeveloped forested land on the west side of Bingaman Creek that is a potential location for the realignment of the stream channel. Realigning portions of a stream channel to avoid columns could alter the hydrology of the reach and would also affect flows and sedimentation downstream. To avoid loss of stream habitat, rerouting would only be feasible in areas where undeveloped space allowed for recreating a functional stream channel with riparian vegetation outside the light rail footprint. The

new recreated stream channel could improve habitat by creating structure such as meanders, riffles, and pools, and placement of LWD. If no potential area for rerouting the stream channel exists, then the stream would likely have to be conveyed through an artificial channel or piped, and would result in a loss of fish habitat within the affected reach. This stream channel was observed to be dry during a field visit in January 2014 and would therefore most likely remain dry in late summer as well. If construction occurred during this dry period, then impacts on any fish inhabiting the stream would be avoided and fish could resume use of the modified channel when flows return.

To the south of S 288th Street, Bingaman Creek lies between an I-5 sound wall to the east and a narrow band (up to 50 feet wide) of forested area to the west that adjoins a mobile home park. Given the narrow, steep banks in this location and the low elevation of the guideway, placement of the guideway columns in this corridor would most likely require relocating and piping the creek within the I-5 right-of-way. Piping this reach would impact any fish species that inhabit this area, although existing habitat is poor and no fish were observed during the field visits. Small species such as sculpin could potentially inhabit this reach and would be displaced by the guideway through this reach.

The I-5 station and alignment options would not have any additional impacts on streams or stream buffers.

SR 99 to I-5 Alternative

The SR 99 to I-5 Alternative avoids most of the stream crossings in the study area, but would have the same direct impacts on Bingaman Creek associated with the I-5 Alternative described above. The SR 99 to I-5 station options would not have any additional impacts on streams or stream buffers.

I-5 to SR 99 Alternative

The I-5 to SR 99 Alternative would span McSorley Creek and Redondo Creek with no direct impacts on the creeks and less than 0.1 acre of impact on stream buffers. Impacts would be greater with some station and alignment options, with up to 0.5 acre of additional stream buffer impact with the S 260th East Station Option and the S 272nd Redondo Trench Station Option.

Vegetation and Wildlife

Vegetation and Wildlife Impacts Common to All Alternatives

The amount of forest cover removed for each build alternative is used to indicate the potential for long-term adverse effects on vegetation and wildlife (Table 4.9-3). The clearing of trees, snags, and understory vegetation for project construction would result in the loss of nesting and foraging sites for many species of birds, as well as reduced availability of hiding cover for small mammals. As with wetland vegetation, elevated structures would have less impact on upland vegetation than at-grade trackways, although forested vegetation would be permanently converted to herbaceous and shrub vegetation cover under elevated guideways. Where the tracks would be at-grade there would be long-term loss of all vegetation within the project footprint. The vegetation management zone that extends 15 feet beyond the footprint of the rail is considered a long-term impact on forested vegetation and wildlife habitat because forested vegetation would not be allowed to regenerate in this area.

Potential impacts of alignments in forested areas would include habitat loss and an increased risk of introducing or spreading invasive species. The risk of disturbance to wildlife due to increased human access, noise, and light would be low because the affected areas are located close to roadways and urban development. The alignments in the areas with the greatest amount of forest cover along I-5 and around McSorley Creek east of SR 99 are located along the edges of these areas near the roadways. None of the proposed alignments cut through the middle of any large undisturbed areas and consequently the potential for fragmentation of wildlife habitat is minimal. The FWLE corridor is highly urbanized and is located alongside existing roadways. Where alignments would be elevated, passage of ground-dwelling animals underneath would be maintained. Impacts on vegetation and habitat are summarized in Table 4.9-3.

Vegetation and Wildlife Impacts by Alternative

SR 99 Alternative

The SR 99 Alternative would result in a total of 3.5 acres of forested cover removed. The potential additional station at S 216th Street (East option), Kent/Des Moines SR 99 East Station Option, Kent/Des Moines HC Campus Station Option, Kent/Des Moines SR 99 Median Station Option, and Federal Way Transit Center SR 99 Station Option would reduce these impacts by traveling through more developed

areas, while the potential additional station at S 216th Street (West option), both options (West and East) for the potential additional station at S 260th Street, and the S 272nd Redondo Trench Station Option would increase these impacts. The options for the SR 99 Alternative could result in a range of 1.6 to 7.6 acres of long-term impacts.

I-5 Alternative

The I-5 alternative would result in a total of 35.4 acres of forested cover removed. The Kent/Des Moines At-Grade Station Option, Kent/Des Moines SR 99 East Station Option, Landfill Median Alignment Option and Federal Way I-5 Station Option would reduce these impacts by traveling through more developed areas, while the Federal Way Transit Center S 320th Park-and-Ride Station Option would increase these impacts. The options for the I-5 Alternative could result in a range of 31.2 to 37.1 acres of long-term impacts.

SR 99 to I-5 Alternative

The SR 99 to I-5 alternative would result in a total of 29.1 acres of forested cover removed. This area could increase if the S 216th West Station Option and the Federal Way Transit Center S 320th Park-and-Ride Station Option were also selected. The options for the SR 99 to I-5 Alternative could result in a range of 28.5 to 31.2 acres of long-term impacts.

I-5 to SR 99 Alternative

The I-5 to SR 99 alternative would result in a total of 5.1 acres of forested cover removed. This would decrease if the Federal Way Transit Center SR 99 Station Option were selected, and would increase if one of the S 260th Street potential additional station options and the S 272nd Redondo Trench Station Option were selected. The options for the I-5 to SR 99 Alternative could result in a range of 4.7 to 8.8 acres of long-term impacts.

Threatened and Endangered Fish and Wildlife Species, Species of Concern, and WDFW Priority Species

Potential long-term impacts on threatened and endangered species (aquatic and terrestrial) include direct mortality, disturbance and displacement effects, and loss or degradation of habitat. Following the identification of a preferred alternative, compliance with the ESA would be assessed and documented through a No Effect memorandum, Biological Assessment, or other ESA documentation.

The assessment will also include a review of potential effects on EFH, as required by the Magnuson-Stevens Fishery Conservation and Management Act.

4.9.4.3 Indirect Impacts

Indirect impacts from operations could result in long-term wetland degradation from stormwater discharges, and alterations in wetland hydrology; however, proper stormwater detention and treatment activities could minimize long-term indirect effects on wetlands.

For aquatic species and habitat, indirect impacts resulting from any of the build alternatives would be minimal due to the heavily developed surrounding areas. The FWLE would not interfere with future projects that may provide habitat improvements, such as the replacement of culverts under SR 99 that are currently fish barriers, or projects that may enhance vegetated and wetland areas in the project corridor. Further design and evaluation of compatibility with crossing of culverts would occur during preparation of the Final EIS.

Long-term impacts on vegetation, wildlife, and wildlife habitat could include disturbance due to increased human access. The introduction of public rail transit in the area would have minor reductions in vehicular traffic on the roadways in the project vicinity compared to the No Build Alternative. This would reduce automotive greenhouse gas emissions and contaminated stormwater runoff from roadways. Indirect effects from potential future development that could be induced by the FWLE would be subject to review under applicable federal, state, and local regulations. This review would trigger the implementation of measures and practices aimed at avoiding or minimizing the potential indirect adverse effects on wetlands, aquatic species and habitat, and other natural resources.

4.9.5 Potential Mitigation Measures

Sound Transit's policy on ecosystem mitigation is to avoid impacts on environmentally sensitive resources and provide adequate mitigation for unavoidable impacts to ensure no net loss of ecosystem function and acreage as a result of Sound Transit projects. Mitigation for ecosystem impacts would be based on a prioritized sequence of avoiding, minimizing, and compensating for unavoidable adverse impacts.

4.9.5.1 Avoidance and Minimization Measures

Sound Transit would avoid and minimize adverse operational effects of the FWLE on wetlands through design to the extent practicable.

Design aspects that could be incorporated into the project include elevated guideways, siting support columns and other elevated guideway features to span and avoid direct impacts on wetlands, and using retaining walls to reduce the at-grade footprint of guideway sections, thus reducing the extent of fill in wetlands.

Sound Transit would also design permanent stormwater treatment facilities and flow-control measures to minimize impacts on stream water quality and flow (as described in Section 4.8, Water Resources). The risk of introducing or spreading invasive species would be minimized by replanting and by implementing best management practices (BMPs) to avoid, reduce, and control the spread of invasive weeds.

Existing stream channels and culverts would be largely avoided by the project alternatives, with the exception of the I-5 Alternative at Bingaman Creek. In this location the stream channel would need to be relocated and a portion potentially conveyed within a new culvert. The new stream channel for the relocated portion would be constructed to incorporate habitat structure such as LWD and pools to improve fish habitat from the existing conditions. Sound Transit would design culverts conveying fish-bearing or potentially fish-bearing streams to comply with federal, state, and local permit conditions, and tribal consultation.

Tree removal along the I-5 corridor would be minimized in association with the I-5 and SR 99 to I-5 alternatives and would be mitigated according to the WSDOT *Roadside Policy Manual* (WSDOT, 2014). Tree removal outside of WSDOT right-of-way would be mitigated to comply with local jurisdictions' tree retention requirements. Operational effects on vegetation, wildlife, and wildlife habitat would be minimized to the extent practicable by minimizing the project footprint through forested areas and connected riparian corridors.

4.9.5.2 Compensatory Mitigation

To the extent that impacts cannot be avoided or adequately minimized, Sound Transit would provide compensatory mitigation to achieve no net loss of ecosystem function and acreage.

Long-term impacts on wetlands and wetland buffers would be mitigated by replacing resources through the use of available approved wetland mitigation banks, the King County in-lieu-fee program, advanced mitigation or through project-specific mitigation developed by Sound Transit. Compensatory mitigation would be

implemented in accordance with applicable federal, state, and local requirements and guidelines, and to the extent possible, mitigation sites would be identified close to impacts and compensated for lost values in-kind. Potential sites under consideration for project-specific wetland mitigation have not yet been identified; however, publicly owned portions of the McSorley Creek Wetland may provide opportunities for mitigation through enhancement.

Mitigation for unavoidable impacts on other ecosystem resources (e.g., streams, stream buffers, vegetation and wildlife habitat) that are protected under federal, state, and local regulations would also be provided. With the exception of Bingaman Creek, the project design would avoid impacts on existing streams, but some unavoidable impacts on stream riparian areas would be mitigated by improving stream habitat and riparian function by replanting affected areas with native vegetation. The loss of open channel in Bingaman Creek could be mitigated by providing improved habitat in a new channel that could be constructed on private property to the west of the I-5 Alternative, north of S 288th Street. Compensatory mitigation may be required for the stream impacts south of S 288th Street where the stream cannot be relocated. Based on consultation with WDFW and the Muckleshoot Tribe, the most beneficial mitigation opportunities may be downstream, east of I-5.

4.10 Energy Impacts

4.10.1 Summary

Operation of the Federal Way Link Extension (FWLE) would result in a slight reduction of passenger and transit vehicle miles traveled as people shift to the light rail system. Overall, FWLE operation is projected to result in 0.1 percent less energy use than the No Build Alternative.

4.10.2 Introduction to Resources and Regulatory Requirements

Operation of motor vehicles, commuter trains, and light rail in the Puget Sound Region consumes large amounts of energy. This section estimates the amount of energy that would be consumed by vehicles operating within the study area, including FWLE light rail, automobile, and other transit use.

There are no federal, state, or local laws that regulate energy consumption in the transportation sector. Many state, local, and regional transportation plans and policies identify goals for the efficient use of energy and energy conservation.

Sound Transit implemented a Sustainability Plan that encourages car trip reduction, the efficient use of energy in operations and facilities, and the use of construction practices that incorporate recycling, salvage, and greenhouse gas reduction.

4.10.3 Affected Environment

The study area for the energy impacts analysis is the same as the study area for the regional transportation analysis (the Puget Sound Regional Council (PSRC) four-county region, which includes King, Pierce, Snohomish, and Kitsap counties) because the regional travel model for vehicle miles traveled (VMT)/ vehicle hours traveled (VHT) includes all four counties. This section discusses the existing energy use and supply in the study area. Detailed information about energy use in the study area is not available; therefore, Sound Transit used state-level energy data to estimate energy consumption at the local level.

4.10.3.1 Washington State Energy Consumption Trends

According to the Energy Information Administration, over 2,060 trillion British thermal units (Btu) of energy were consumed in Washington in 2010 (U.S. Energy Information Administration, 2012a),

enough energy to meet the needs of nearly 23 million households (Clean Technica, 2012). From 1980 to 2000, Washington's per capita energy consumption was approximately 250 million Btu (MMBtu), which is the energy equivalent of approximately 2,000 gallons of gasoline per person (Washington State Department of Commerce, 2012). More recently, the state's per capita energy consumption has been closer to 200 MMBtu as a result of higher fuel prices, the decline of the aluminum manufacturing industry in the state, and a downturn in the national and regional economy (Washington State Department of Commerce, 2012).

In 2010, the transportation sector in the state of Washington consumed approximately 328.6 trillion Btu of gasoline and approximately 114.6 trillion Btu of distillate fuel (U.S. Energy Information Administration, 2012b). This accounts for approximately 22 percent of all energy consumed in the state. Table 4.10-1 presents daily VMT and energy consumption by transportation mode for the region. According to the PSRC traffic model and the Sound Transit ridership model, the existing daily VMT for the study area is approximately 87.6 million. The daily energy use by the different transportation modes is approximately 5.7 x 10^{11} Btu (572,350 MMBtu).

TABLE 4.10-1
Study Area Existing Daily Vehicle Miles Traveled and Energy Consumption (2012)

Vehicle Type	Energy Consumption Rate (Btu per mile)	Existing Conditions	
		Daily VMT[a]	MMBtu
Passenger Vehicle	5,807[b]	83,766,970	486,416
Heavy Duty Truck	21,698[b]	3,759,050	81,564
Transit Bus	37,718[b]	96,000	3,621
Light Rail	33,068[c]	8,800	291
Commuter Rail	95,494[c]	4,800	458
Total		87,635,620	572,350

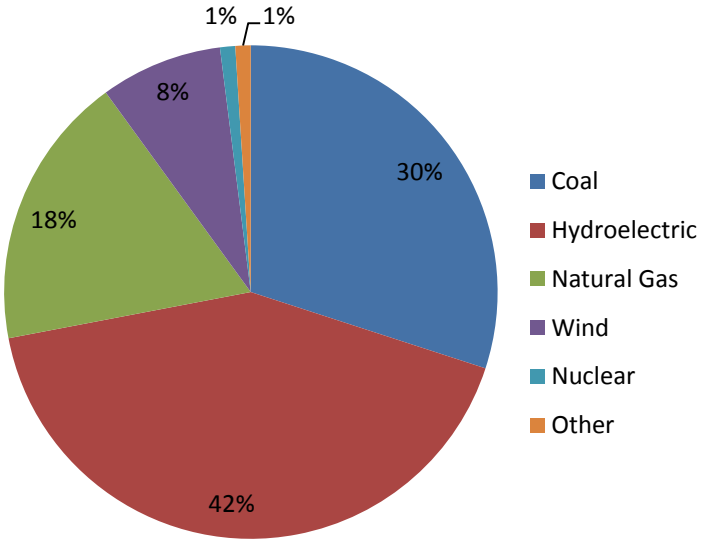
[a] Sources: PSRC, 2012; Sound Transit, 2012.

[b] Source: Oak Ridge National Laboratory, 2013.

[c] Source: Sound Transit, 2014.

4.10.3.2 Electricity Supply in Study Area

Puget Sound Energy, which provides electricity to the study area, is the largest energy utility in Washington and provides electric power to more than 1 million customers. Its electricity is generated using a number of different resources. In 2012, hydroelectric power accounted for 42 percent of the utility's power generation portfolio. Puget Sound Energy also produces power from thermal power plants, a large coal-fired generating facility in Montana, wind farms, and natural-gas-fired power plants in the Puget Sound Region. Exhibit 4.10-1 illustrates the utility's energy source mix.



Source: Puget Sound Energy, 2014.

EXHIBIT 4.10-1
Puget Sound Energy Source Mix, 2012

In 2013, Puget Sound Energy had peak power resources of approximately 4,800 megawatts (PSE, 2014). Of this total, the utility had about 3,600 megawatts of company-controlled power-generating capacity. The remaining power supply came from a variety of other utilities, independent power producers, and energy marketers across the western United States and Canada (PSE, 2014). Approximately 50 percent of the electricity Puget Sound Energy customers use comes from Puget Sound Energy-owned generation.

4.10.4 Environmental Impacts

The energy analysis evaluates operational energy use by the FWLE and the demand on regional energy supply.

Sound Transit estimated operational impacts from the VMT estimates by mode presented in the PSRC traffic forecast model. The study area total VMT estimates for light rail were modeled based on the projected operations plan for the combined Link system of light rail. The regional VMT was separated into passenger miles and heavy truck miles to account for differences in energy consumption levels. All energy consumed was converted to Btu to provide a common measure among all energy sources. The energy consumption rate (Btu per vehicle mile) for each motor vehicle type (cars, trucks and buses)

was obtained from the *Transportation Energy Data Book, Edition 32* (Oak Ridge National Laboratory, 2013). The energy consumption rate for light rail and commuter rail vehicles was obtained from the Sound Transit Sustainability Inventory (Sound Transit, 2014). Energy consumption rates are listed above in Table 4.10-1. The VMT, energy consumption rate (Btu per mile), and total energy consumption for the No Build and Build alternatives are presented in Table 4.10-2. The light rail VMT for the No Build Alternative includes the extension of the light rail system to Lynnwood in the north and Overlake Transit Center in the East.

TABLE 4.10-2
Daily Vehicle Miles Traveled and Energy Consumption

Vehicle Type	Energy Consumption Rate (Btu per mile)	2035 No Build Alternative		2035 Build Alternatives		% Change in Btu from No Build Alternative
		Daily VMT[a,b]	MMBtu	Daily VMT[b]	MMBtu	
Passenger Vehicle	5,807[c]	97,934,180	568,681	97,780,490	567,789	-0.2%
Heavy Duty Truck	21,698[c]	5,826,200	126,417	5,825,700	126,406	0.0%
Transit Bus	37,718[c]	107,500	4,055	107,200	4,043	-0.3%
Light Rail	33,068[d]	32,800	1,085	36,800	1,217	12.2%
Commuter Rail	95,494[d]	7,600	726	7,600	726	0.0%
Total		**103,908,280**	**700,963**	**103,757,790**	**700,181**	**-0.1%**

[a] Source: PSRC, 2012.
[b] Source: Sound Transit, 2012.
[c] Source: Oak Ridge National Laboratory, 2013.
[d] Source: Sound Transit, 2014.

4.10.4.1 No Build Alternative

Under the No Build Alternative, the daily VMT for the study area is projected to increase from approximately 87.6 million in 2012 (see Table 4.10-1) to approximately 103.9 million in 2035. The No Build Alternative would place additional demands on energy in the region as a result of increased passenger trips, greater levels of congestion, and slower speeds and, therefore, increasing greenhouse gas emissions. However, the additional demand on the electric utilities that the light rail system would place on the electric grid would not occur.

4.10.4.2 Build Alternatives

All build alternatives would be of similar length and ridership; therefore, this analysis applies to direct impacts for all alternatives.

No indirect impacts would occur. Construction impacts related to energy are discussed in Chapter 5.

When compared to the No Build Alternative, the FWLE would result in a slight regional reduction of passenger and transit vehicle miles traveled, and therefore less energy consumption, as people shift to the light rail system.

Operation of the light rail system would place a demand on the local electrical utility, Puget Sound Energy. Under the build alternatives, light rail vehicles are expected to travel 4,000 more total rail car miles per day than the No Build Alternative. This additional mileage is expected to result in energy use of approximately 132 MMBtu per day, or 38.7 megawatt hours (MWh) per day. Assuming that the light rail system would operate 365 days per year, the additional annual MWh consumed by the Build alternatives would be nearly 14,000 MWh. This represents less than 0.1 percent of the total Puget Sound Energy 2011 power generation. Overall, energy use during project operation is projected to result in 0.1 percent less energy use than the No Build Alternative.

4.10.5 Potential Mitigation Measures

Operation of the FWLE is expected to consume less energy overall than the No Build Alternative. It is not expected to overburden the electric utilities' power availability; therefore, no mitigation would be required. During final design, Sound Transit would investigate methods of reducing energy use during operations as part of its Sustainability Initiative.

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4.11 Geology and Soils

4.11.1 Summary

New slopes and new earth fills would be required for all build alternatives, which would travel though areas where geologic hazards exist, such as erosion, steep slopes, landslides, and seismic hazards. These hazard areas are not extensive for any alternative. Sound Transit anticipates that the effects of the FWLE on local geology and effects of geology on the FWLE would be minor for all the build alternatives and manageable through typical design efforts.

Appendix D4.11 presents additional information on the geology of the FLWE corridor, including maps.

4.11.2 Introduction to Resources and Regulatory Requirements

Geology and soil considerations that could affect or be affected by the build alternatives include topography, geology, soil characteristics, groundwater location, and geologic hazards. This assessment of geology and soils considered both regional and project-specific conditions. The regional considerations include geology and seismicity of the Puget Sound area; project-specific considerations include topography, soil conditions, groundwater location, and geologic hazards along the build alternatives alignments. While geology and soil conditions are described for the project vicinity, the potential for impacts was determined by looking within a study area of 100 feet from either side of each alternative, station, or ancillary facility.

The regulatory requirements applicable to the FWLE corridor include the Washington State Growth Management Act (GMA) (Revised Code of Washington Chapter 36.70A). Under the GMA, all cities and counties are required to identify critical areas within their jurisdictions and to formulate development regulations for their protection. The GMA defines geologically hazardous areas or critical areas as areas that are susceptible to erosion, sliding, earthquake, or other geological events. The hazards could affect the design, construction, and operation of the FWLE and, if not considered appropriately, could pose a risk to public health and safety.

Geology and soils considerations are closely related to groundwater conditions. This section includes general information on groundwater in the project vicinity, as related to the assessment of geologic

hazards. More detailed information on groundwater locations and uses along each alternative is discussed in Section 4.8, Water Resources. Locations of possible contaminated soils and contaminated groundwater are identified and discussed in Section 4.12, Hazardous Materials.

4.11.3 Affected Environment

Sound Transit assessed the regional geology, topography, seismicity, site geology, and geologic hazards using available printed and online maps published by government agencies, including the U.S. Department of Agriculture (USDA) and the U.S. Geological Survey (USGS). Sound Transit also collected available geotechnical reports for previous projects conducted in and near the FWLE corridor. A total of 53 historical geotechnical or hydrogeologic reports or partial reports were identified (from 1954 through 2007; listed in Appendix D4.11, Table D4.11-1). Locations of soil borings advanced in those investigations are shown on Exhibit D4.11-1 in Appendix D4.11. Appendix D4.11 also includes a summary of the geologic units and engineering properties within the study area and maps of regional geology, topography, erosion hazard areas, steep slopes, and seismic hazard areas.

4.11.3.1 Regional Geology

The FWLE is located within the central Puget Lowland, a north-south trending trough bordered by the Cascade Mountains to the east and the Olympic Mountains to the west. The existing topography and regional geology have been largely shaped by past glacial activity. The regional geology includes a thick sequence of glacially consolidated soils overlying bedrock, which is typically 600 to 1,200 feet below the ground surface in the project vicinity (Jones, 1996). The surface geology along both the SR 99 and I-5 corridors was heavily modified during construction of I-5 and SR 99, and therefore the discussion of the study area geology is primarily focused on the underlying native geology.

4.11.3.2 Topography

The study area is located in an upland area bounded by the Green River Valley to the east and Puget Sound to the west. Ground surface elevations typically range from approximately 250 to over 400 feet above sea level (USGS, 2004a; USGS, 2004b). The study area has local depressions, stream channels, lakes, and wetlands that are underlain

by more recent soils, including recessional outwash and wetland deposits.

4.11.3.3 Seismicity

The Puget Sound Region is located at the convergent continental boundary known as the Cascadia Subduction Zone (CSZ). Relative movement between the North American Plate and subducting Juan de Fuca Plate at this boundary has resulted in a long history of seismic events in the Puget Sound Region. These events are associated with three primary sources: shallow earthquakes in the crust of the North American Plate, deep subcrustal zone (intraslab) earthquakes in the subducted Juan de Fuca Plate in the CSZ, and very large earthquakes at the interface between the Juan de Fuca Plate and North American Plate.

One of the consequences of plate movement is the potential for ground displacement from fault rupture. These ruptures occur within the North American Plate. The closest active faults in the area include the Seattle and Tacoma faults. In addition to being the source of strong ground shaking, the faults can result in ground displacement. The FWLE corridor is located outside of known fault zones, so the risk of fault displacement is low.

4.11.3.4 Site Geology and Groundwater Conditions

Based on the geologic mapping and existing geotechnical reports, the study area is typically underlain by glacially consolidated soils and more recent soils, including unconsolidated recessional outwash and wetland deposits. Groundwater is typically located within 20 feet to 155 feet of the ground surface; however, in some locations, shallow or perched groundwater occurs (WDNR, 2014). In areas mapped as wetlands, groundwater can be from a few feet below the ground surface to at the ground surface. Section 4.8, Water Resources, describes groundwater in the study area.

Similar geologic and groundwater conditions exist for all build alternatives, with the exception of the I-5 Alternative at the Midway Landfill. The landfill is a Superfund site, as discussed in Section 4.12, Hazardous Materials. The demolition debris and municipal waste that make up the landfill create a zone of poor bearing material that would be susceptible to large and erratic settlement under new earth or structural loading. A potential for gas and contaminated groundwater also exists in the landfill, as discussed in Section 4.8,

Water Resources; Section 4.12, Hazardous Materials; and Chapter 5, Construction.

4.11.3.5 Geologic Hazards

The cities of SeaTac, Des Moines, Kent, and Federal Way and unincorporated King County all have defined geologically hazardous areas in their respective land use codes. Geologic hazards in the study area include the following:

- Soils that are potentially susceptible to erosion. In general the erosion hazard is low within the study area, although surficial soils are prone to erosion if left exposed (e.g., during land clearing activities for installation of alignment infrastructure). Certain types of soil, such as silt, are more prone to erosion hazards. The potential for erosion also increases as the slope steepness increases.
- Steep slope hazard areas, with slopes having slope angles between 15 and 40 percent. These slopes may move during wet weather or seismic events.
- Landslide hazard areas where past slides have occurred, where the soil types under steep slopes make them unstable, or any areas where the slope is steeper than 40 percent.
- Seismic hazard areas subject to fault displacement or earthquake-induced ground shaking. Liquefaction is the key seismic hazard in the region because some areas have saturated loose granular soils that can become unstable in a seismic event. Areas with wetland deposits are interpreted as seismic hazard areas.
- Settlement hazard areas where the soft soils are subject to settlement under increased loads from embankments or structures. Areas mapped with wetland deposits are interpreted as settlement hazard areas. Other localized deposits of soft soils could also exist.

Geologic hazards can also include tsunamis, seiches, and volcanic hazards. The FWLE is located at an elevation that precludes tsunami hazards, and bodies of water near the corridor are too small to result in a hazardous seiche. The alignments are also outside areas that would be affected by lahars (volcanic mudflow) associated with a volcanic eruption in the Cascade Mountain range.

4.11.4 Environmental Impacts

This section summarizes the impacts that could result from the No Build Alternative and the build alternatives. The impacts include changes to geology and soils caused by the FWLE, as well as how geologic hazards could affect the FWLE. The impacts of geologic hazards on the project are identified where these hazards could present a future risk to the safe operation of the FWLE.

4.11.4.1 No Build Alternative

Under the No Build Alternative, the FWLE would not be constructed. The existing geology and soils environment would essentially remain unchanged.

4.11.4.2 Build Alternatives

For the FWLE, the discussion of impacts covers the general impacts that are common to all alternatives, and then the key differences in impacts for the alternatives. Chapter 5, Construction, provides an overview of the potential construction activities, their impacts, and timing of those activities.

Direct Impacts

Slope Stability, Retaining Structures, and Landslides

Earth slopes and retaining wall structures could be a hazard if not permanently stabilized. Earth slopes include existing slopes, slopes that could be steepened as part of the FWLE, and slopes for embankment fills needed to support the alignment. The risk of insufficient slope stability would be greater if a large seismic event were to occur.

All build alternatives have steep slope and landslide hazard areas along the alignments (see Exhibit D4.11-5). Most of the landslide hazard areas are located over 500 feet from the alternatives. Where land clearing would be conducted for installation of the alignment infrastructure in steep slope areas, soil erosion hazards could increase. However, erosion control management practices would be implemented to mitigate hazards, keeping the overall risk low.

Although all alternatives would pass through or would be located near steep slopes, the overall risk of impacts from instability of steep slopes would be low for these locations. This is because the occurrence of steep slopes along the alternatives alignments is limited and, in general, competent ground conditions exist in most areas along the corridor.

The one exception to these conditions is along the S 272nd Redondo Trench Station Option for the SR 99 Alternative, where approximately 3 miles of this alignment option would travel through areas with steep slopes, as shown on Exhibit D4.11-5 and on the topographic map, Exhibit D4.11-3. Although the geologic units underlying this area are mapped dense to very dense and could provide excellent foundation support and stable cuts (Table D4.11-2), the 3-mile stretch of steep slopes are located close to the alignment and in combination with shallow groundwater, if encountered, could be susceptible to slope instabilities. Groundwater depths throughout the FWLE corridor range from 20 to 155 feet below ground surface and are suspected to be at the higher end of the range along this alignment option (WDNR, 2014). Preventative measures such as slope stabilization or retaining walls would be implemented to stabilize the areas of potential risk.

Seismic Hazards

Seismic ground shaking during light rail operation would be transmitted into the light rail vehicles operating on the tracks, causing increased inertial loading and movement within structures supporting the light rail system.

If the FWLE is located on sloping ground, the ground shaking could also result in permanent movement of the ground and the supported facilities. Seismic ground shaking could also lead to liquefaction of loose, saturated, cohesionless soils; settlement from densification of loose soils; increased risk of unstable earth slopes and retaining walls; and increased earth pressures on retaining walls. The areas underlain by soft or loose soils along the alternatives are identified as seismic hazard areas because these areas are more likely to experience intense ground shaking from seismic events.

Although these impacts could present a risk to light rail facilities and users, the elevated, at-grade, and below-grade light rail support systems and retaining structures, including retained fills or cuts, would be designed to withstand the effects of seismic ground shaking, thus minimizing the risks to rail facilities and users. The Sound Transit light rail design standards are based on the occurrence of a rare, very large seismic event with a probability of occurrence of 2 percent in 50 years, which equates to an approximate return period of once every 2,475 years. Based on these design standards, the risk of damage from seismic ground shaking would be low.

Settlement of New Earth Fills

Retained fills would be used in some areas where the FWLE facilities would be above the existing grade. Walls would typically be used to retain the fill, thereby minimizing the area covered by fill. The fill would cause increased loads on the existing soil, which could result in settlement of soft soil. If not mitigated, this settlement could damage light rail structures, as well as nearby structures, roadways, and utilities.

The overall risk of settlement for all alternatives is low. Project design would incorporate measures to improve the soils in locations where the potential for settlement is identified, or would allow tolerances for anticipated settlement. Most of the new earth fills would be located in areas underlain by glacially consolidated soils, which are not expected to experience settlement, as these soils have already been loaded with much higher pressures from glaciers. In areas where settlement-prone soils exist, such as at the Midway Landfill along the I-5 Alternative and in areas near wetlands north of S 272nd Street where the potential additional station at S 260th Street (East option) and the S 272nd Redondo Trench station options would be built, mitigation measures would be used to avoid the detrimental effects of settlement. The I-5 Landfill Median Alignment Option would avoid this issue on the Midway Landfill.

Light Rail Facilities

Elevated guideway structures and light rail stations could have shallow or deep foundations; below-grade stations or track would most likely be located on either shallow foundations or existing soil.

Retaining structures would be required in areas along the alternatives alignments where the track or stations would either be below-grade in a trench or above-grade on retained fills. Some retaining structures could require permanent soil anchors or tiebacks that extend beyond the limits of the project footprint onto adjacent properties, which would require permanent easements and could affect the future use of neighboring properties. Retaining structures can affect or be affected by local groundwater movement and seepage. The retaining structures' design would consider groundwater conditions and provide appropriate means of drainage or waterproofing for control of groundwater.

Parking structures could be supported on shallow or deep foundations, depending on ground conditions at the parking structure

location. Ground improvement may also be used in combination with shallow foundations if soft or loose soils are encountered at the ground surface and structure loads are not too high. Surface parking lots would be supported at grade.

Stormwater facilities would be required along the FWLE to treat and discharge increased runoff from the project impervious areas, such as guideways, parking lots, or structures. Where possible, low-impact design principles would be used, focusing on infiltration where possible. Geologic units within the study area that are often feasible for infiltration include pre-Olympia gravel deposits, pre-Fraser coarse-grained deposits, advance outwash, and recessional outwash. Additional information about the permeability characteristics of the geologic units is included in Table D4.11-2. See Section 4.8, Water Resources, for additional information on stormwater facilities.

Changes in Groundwater Flow

Retaining walls used to support retained fills or cuts can affect or be affected by local groundwater movement and seepage. In areas where groundwater depths are 20 feet or less below the ground surface, the retaining structures could change shallow groundwater flow directions. Additionally, increased infiltration from stormwater runoff over impervious areas, such as parking lots, could temporarily increase groundwater levels and flow following storm events. This impact would be more likely to occur in areas where depth to groundwater is 20 feet or less.

Indirect Impacts

Indirect impacts could result from permanent soil anchors or tiebacks that would be used in retaining wall structures. These wall support systems could restrict the type of excavations feasible for future developments within the anchor zones.

4.11.5 Potential Mitigation Measures

During final design, Sound Transit would conduct additional geotechnical studies involving borings and other exploration methods, laboratory testing of soil, and detailed foundation design evaluations to inform and refine development of design and construction techniques and potential mitigation measures. At sites where geologic conditions are not suitable, appropriate design and construction measures as described in Section 4.11.4, Section 5.2.12, and Section 5.3.12 would be refined and implemented to avoid potential adverse effects and geologic risks during operations.

4.12 Hazardous Materials

4.12.1 Summary

The SR 99 Alternative has a higher number of high-risk hazardous materials sites within or adjacent to its footprint than the other alternatives (Table 4.12-1). While the I-5 Alternative has the lowest number of high-risk sites within or adjacent to its footprint, it would cross the Midway Landfill, a Superfund site. The landfill is covered with a thick, sealed cap. The risk associated with crossing the landfill may be substantial because of the regulatory requirements associated with altering the cap and installing light rail columns in or through the landfill. The I-5 Landfill Median Alignment Option, however, would avoid the landfill and the potential impacts associated with this crossing. Appendix D4.12 includes a table of all hazardous material sites in the study area, along with a map of soil arsenic concentrations in the study area associated with the ASARCO smelter plume.

TABLE 4.12-1
Number of Contaminated Sites within the Project's Long-Term Footprint

Alternative	Number of High-Risk Sites within Project's Long-Term Footprint (Range with Options)
SR 99 Alternative	**6** (5-7)
I-5 Alternative	**1** (0-2)
SR 99 to I-5 Alternative	**3** (2-4)
I-5 to SR 99 Alternative	**3** (3-3)

4.12.2 Introduction to Resources and Regulatory Requirements

Hazardous materials can be classified in a number of different ways based on laws and regulations that define their characteristics and use. The categories generally include hazardous waste, dangerous waste, hazardous substances, and toxic substances.

Applicable laws and regulations include the following:

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (42 United States Code [U.S.C.] 9601, et seq.)
- Superfund Amendments and Reauthorization Act (Public Law No. 99-499)
- Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901, et seq.)
- Clean Water Act (33 U.S.C. Section 1251, et seq.)
- Toxic Substances Control Act (15 U.S.C. 2601-2629)
- Dangerous Waste Regulations (Washington Administrative Code [WAC] 173-303)
- Model Toxics Control Act (MTCA) (WAC 173-340)
- Underground Storage Tanks (WAC 163-360)
- Sediment Management Standards (WAC 173-204)

Section 4.2, Land Use, describes existing land uses in the study area and Sections 4.8, Water Resources, and 4.11, Geology and Soils discuss related resources and regulatory requirements that pertain to contaminated sites.

4.12.3 Affected Environment

The hazardous materials analysis study area is the area within an approximately 1/8-mile radius from each alternative. Within this study area, contaminated sites could affect the project or the project could affect the site.

Sound Transit acquired information from multiple sources about sites with known contamination or potential contamination within the study area, as well as relevant historical conditions within the study area. Sources included the following:

- Environmental agency database records (Environmental Data Resources, Inc. [EDR], 2013a, 2013b)
- Historical aerial photographs (Washington State Department of Transportation [WSDOT], 2013)
- Online King County Assessor data (King County GIS Center, 2013)
- Current and historical topographic maps (EDR, 2013b)

- Historical city directories for south King County and Kent, Washington
- Windshield survey of the FWLE corridor on March 15, 2013

Agency records reviewed include those maintained by the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). These databases track properties with potential or confirmed hazardous material releases to the environment and facilities that manage hazardous materials as part of their operations.

A search of the EPA and Ecology databases was conducted in January 2013 (EDR, 2013a) to identify sites in the study area that have a record of hazardous material, substance, or waste handling, or that could be contaminated or have been contaminated in the past. The approximate locations of the sites identified are shown on the maps in Appendix D4.12. Appendix D4.12 also presents tables with detailed information about these sites.

Based on the information collected, sites were categorized into three risk categories: high, medium, and low. The purpose of this risk analysis was to prioritize sites based on the need for avoidance, remediation, or mitigation while considering associated costs and liability. The risk levels are defined as follows:

- **High-risk** sites are properties that might be substantially contaminated and might create liability for Sound Transit either due to construction activities or by virtue of acquiring all or a portion of the site. High-risk sites typically have contaminants that are difficult to treat (for example, tetrachloroethene [PCE]), have large volumes of contaminated materials, or have long histories of industrial or commercial use.
- **Medium-risk** sites are properties where the nature of potential contamination is known based on existing investigation data, the potential contaminants are not extremely toxic or difficult to treat, and probable remediation approaches are straightforward. These sites are typically located within or adjacent to project construction limits and have soil contaminated with petroleum products, or are nonadjacent sites that have groundwater contaminated with petroleum products.
- **Low-risk** sites are properties where the nature of potential contamination is known based on existing investigation data, and

the sites are not expected to have noticeable impacts on the project alternatives due to their location. These sites are typically not directly adjacent to the FWLE right-of-way and do not have groundwater contamination.

Table 4.12-2 lists the number of sites within the project's long-term footprint for each alternative by risk category and provides a range of these sites for the options associated with each alternative. Appendix D4.12 provides more detail on the number of properties within the study area of each option.

For the high-risk sites, files were reviewed at Ecology in January and February 2014 to further understand the potential risks of the sites. Files were also obtained from Seattle Public Utilities in October 2013 and January 2014 regarding the Midway Landfill. These sites are shown on Exhibits 4.12-1 and 4.12-2.

The study area for all alternatives is also within a plume of arsenic- and lead-impacted soils originating from aerial deposition of metals emitted from the former ASARCO smelter in Tacoma, which operated from 1890 until 1985. Ecology has published a map of arsenic concentrations in the top 6 inches of soil in the Puget Sound Region (Ecology, 2009, 2012). Appendix D4.12 provides a copy of the map. Elevated levels of lead are also associated with the ASARCO smelter plume, but were not mapped by Ecology.

4.12.4 Environmental Impacts

4.12.4.1 No Build Alternative

With the No Build Alternative, there would be no project-related removal or cleanup of potentially hazardous materials in the study area, including contaminated soil or groundwater, and the potential uncontrolled migration of existing contaminants would likely continue.

4.12.4.2 Build Alternatives

This section discusses the potential long-term, operational impacts that the build alternatives could have on known contaminated sites, and the potential impacts that the contaminated sites could have on project development and Sound Transit's liability. Impacts during construction activities, including excavation and soil disturbance, are discussed in Chapter 5, Construction.

TABLE 4.12-2
Number of Sites within Study Area (1/8 mile of Each Alternative)

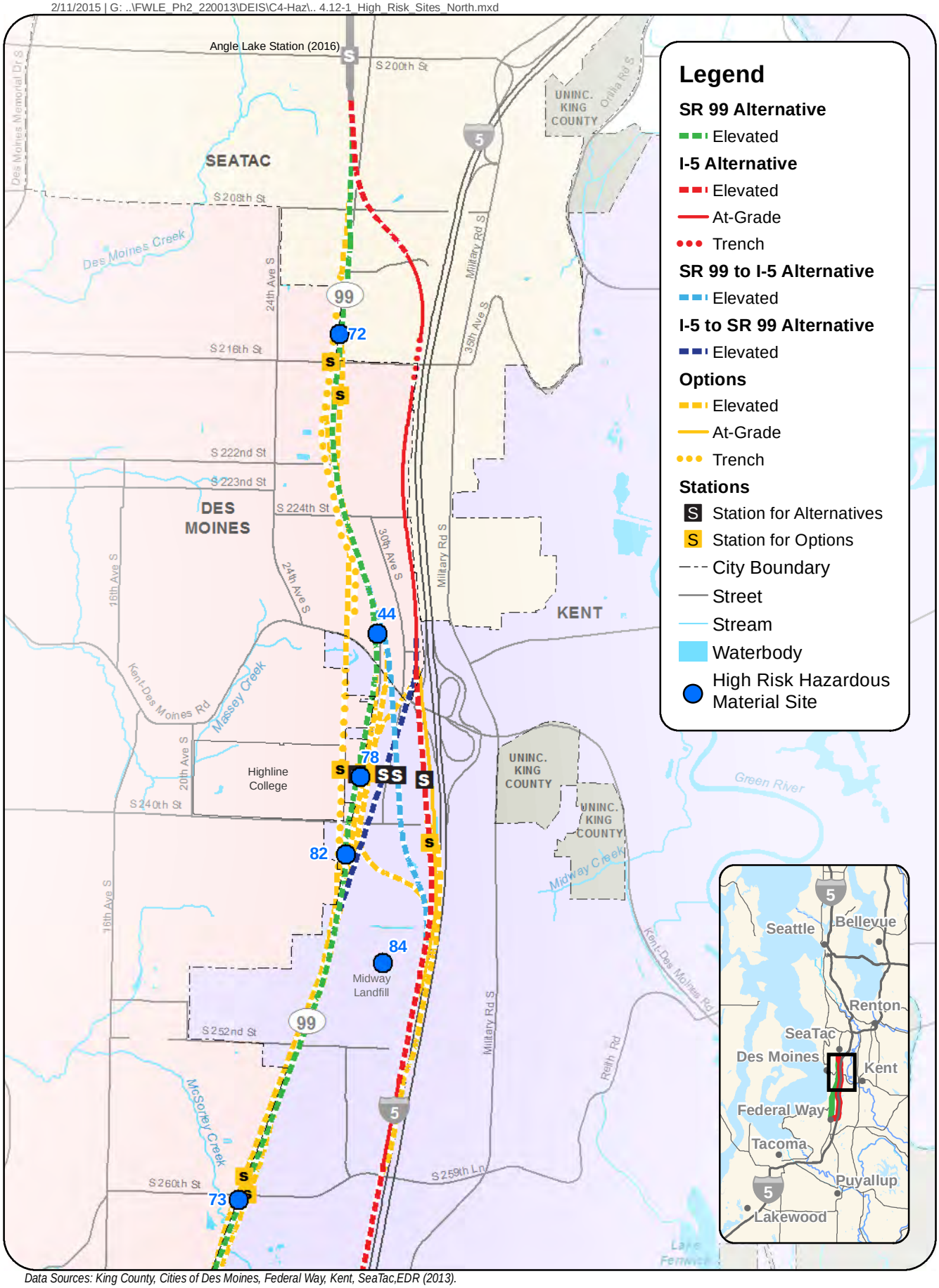
Alternatives	Number of Sites within Study Area (Range with Options)		
	High Risk Level	Medium Risk Level	Low Risk Level
SR 99 Alternative	**11** (11-12)	**72** (64-72)	**86** (86-86)
I-5 Alternative	**2** (1-3)	**6** (4-10)	**59** (59-60)
SR 99 to I-5 Alternative	**5** (4-6)	**38** (35-38)	**48** (48-49)
I-5 to SR 99 Alternative	**7** (7-7)	**39** (38-39)	**68** (68-68)

Note: The number of hazardous material sites for all risk levels should be considered as a snapshot in time. Actual facility environmental conditions vary over time and environmental databases are constantly being updated. Sites are added or deleted regularly. The number of medium- and low-risk sites should be approximate because the site locations have been identified as a single point and portions of a property can fall inside or outside of the 1/8-mile (660-foot) buffer.

Direct Impacts

Long-term impacts could occur when Sound Transit acquires properties that are the source of contamination and, therefore, could require ongoing cleanup responsibility. Such sites are typically associated with groundwater contamination or are large and complex. The actual long-term impacts at such hazardous materials sites cannot be identified or assessed without evaluating in detail site-specific conditions, which would be performed before, during, or after construction. The high-risk sites that could be directly affected by build alternatives are shown in Exhibits 4.12-1 and 4.12-2, and described below by alternative. Additional high-risk sites, not described below or included in Exhibits 4.12-1 and 4.12-2, are present within the FWLE corridor and are listed in Appendix D4.12. These sites have been ranked as “High” based on the potential for significant contamination; however, based on the alignment of alternatives and station options, these additional high-risk sites are not expected to be affected by the FWLE.

Contamination at any site affected by the FWLE would be addressed before and during project construction (see Chapter 5). Long-term monitoring or other protective measures or restrictions could be required. Long-term monitoring is currently occurring at the Midway Texaco (Map ID site 44), Midway Cleaners (Map ID Site 78), Arco 5363 (Map ID Site 85), 7-Eleven 18758 (Map ID Site 73), and the Midway



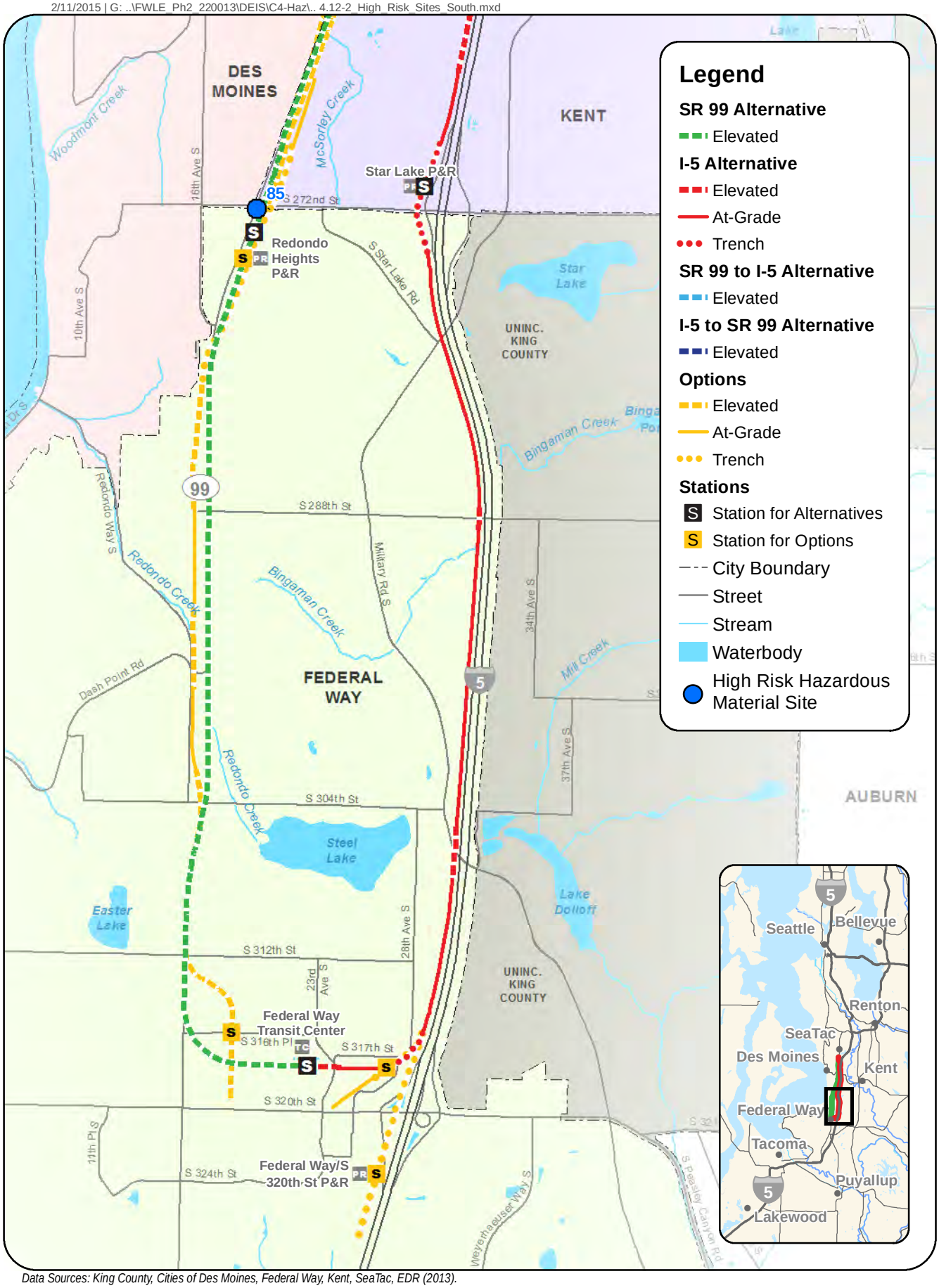
Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac,EDR (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.12-1
High Risk Hazardous Material Sites (North)

Federal Way Link Extension



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac, EDR (2013).

N

0 0.25 0.5 1 Miles

EXHIBIT 4.12-2
High Risk Hazardous Material Sites (South)

Federal Way Link Extension

Landfill (Map ID Site 84). Each of these is within the footprint of one or more alternatives.

Each site would be handled in accordance with the requirements of applicable regulations and approvals and the specific site needs. The likelihood of impacts (i.e., releases) from FWLE operations and maintenance activities would be low. Because the trains operate using electricity, fuel spills would not occur and impacts during normal operation are unlikely. However, minor impacts during operations could result from use of hazardous materials during maintenance activities on the tracks. There would be a low chance that a small amount of diesel fuel or hydraulic fluid could spill from maintenance vehicles during track maintenance. There would be no impacts during operation related to the ASARCO smelter plume. Construction impacts related to the smelter plume are discussed in Chapter 5, Construction.

SR 99 Alternative

With the SR 99 Alternative, long-term impacts could occur at the following high-risk sites if Sound Transit acquires all or part of these properties:

- Sunmart 1 (Map ID Site 72) is a former service station with known groundwater contamination for petroleum. This property would be partially acquired for the SR 99 alternative and most station options. It would be fully acquired for the potential additional station at S 216th Street (West option).
- Midway Texaco (Map ID Site 44) is an active service station with known groundwater contamination for petroleum. This property would be fully acquired for the SR 99 Alternative as well as for the Kent/Des Moines SR 99 Median Station Option. The Kent/Des Moines HC Campus Station Option and the SR 99 East Station Option would avoid this property.
- Midway Cleaners (Map ID Site 78) is a dry cleaning business with known contamination of PCE in soil and groundwater. The property would be fully acquired for the SR 99 Alternative and station options except the Kent/Des Moines SR 99 East Station Option, which would avoid this property.
- Japanese Auto Sales & Service (Map ID Site 82) is a former auto sales and service property that was investigated by regulatory agencies for failing to store and handle dangerous waste properly.

This property would be partially acquired for the SR 99 Alternative. The Kent/Des Moines HC Campus Station Option and the potential additional station at S 260th Street (West option) would fully acquire this property, and the Kent/Des Moines SR 99 East Station Option would avoid this property.

- 7-11 Eleven No. 18758 (Map ID Site 73) is an active service station with known groundwater contamination for petroleum. This property would be partially acquired for the potential additional station at S 260th Street (West option).
- Arco 5363 (Map ID Site 85) is an active service station with known groundwater contamination for petroleum. This property would be fully acquired for the SR 99 Alternative.

I-5 Alternative

With the I-5 Alternative, long-term impacts would only occur with crossing the Midway Landfill (Site 84). This site is a 60-acre former gravel quarry that was used as an unlined landfill from 1966 to 1983. The Midway Landfill is active on the National Priorities List (NPL) and has confirmed groundwater contamination. Sites on the NPL, also known as Superfund, have been identified for priority cleanup by EPA. Deed restrictions are in place for the site.

The Midway Landfill is closed and capped. The current landfill cap consists of 1 foot of cover soil over a 1-foot drainage layer, which is over filter fabric, a drainage net, and a 50-mil high-density polyethylene membrane, all of which are over a 1-foot compacted soil/clay layer. There are numerous wells in place to capture gases from below the cap. The type and magnitude of impacts at the landfill would be dependent on the crossing option.

Two crossing options are being considered. One option is to cross the landfill using an elevated guideway supported by drilled shafts. The construction of the drilled shafts would require removal of a portion of the landfill cover, removal of waste material, drilling shafts up to 10 feet in diameter, and replacement of the landfill cover around the shafts. The other option to cross the landfill would require removal of a portion of the cover, compaction of waste material in place, replacement of the cover over the compacted waste, and placement of ballast material for the tracks at ground level. The overhead catenary system poles would be supported by small drilled shafts.

Both options would require regulatory approval from EPA and Ecology.

Penetrations of the landfill, such as drilled shafts, would be constructed so that the landfill liner is replaced around the shafts to prevent surface water infiltration and leachate migration in the long term. The compaction of waste and replacement of the liner would prevent any surface water infiltration post-construction because the existing liner and replacement liner would be reconnected and sealed. Based on the current conceptual design, drilled shafts would be approximately 50 to 75 feet deep. The best available information related to groundwater monitoring at the landfill indicates the shaft depths would be approximately 35 feet or more above groundwater. Compaction of the waste would minimize the creation of new leachate pathways to groundwater in the long term.

Long-term commitments associated with crossing the Midway Landfill would likely include monitoring the cover to ensure its integrity, preventing surface water infiltration into the landfill, and preventing gas migration from the landfill. The Landfill Median Alignment Option would avoid impacts on the landfill. No other contaminated sites within the study area would be affected by this alternative.

SR 99 to I-5 Alternative

Long-term operational impacts could occur at the following high-risk sites with the SR 99 to I-5 Alternative: Sunmart 1 (Site 72), Midway Texaco (Site 44), and the Midway Landfill (Site 84). Potential impacts associated with Sunmart 1 (Site 72) and Midway Texaco (Site 44) would be the same as discussed for the SR 99 Alternative. Potential impacts associated with Site 84 would be the same as discussed for the I-5 Alternative.

I-5 to SR 99 Alternative

Long-term operational impacts could occur at the Arco 5363 (Site 85) with the I-5 to SR 99 Alternative, and the potential impacts would be the same as discussed for the SR 99 Alternative.

Indirect Impacts

The FWLE would support redevelopment of properties around station areas where local zoning allows. Properties where contamination is present could be cleaned up for redevelopment earlier than might otherwise occur, which would be an indirect benefit of the project.

4.12.5 Potential Mitigation Measures

In order to mitigate potential impacts from all potential hazardous materials sites, Sound Transit would perform a level of environmental due diligence appropriate to the size and presumed past use of the property at all properties along the corridor before they are acquired. Phase 2 environmental site assessments would be conducted where appropriate. Where known hazardous materials are present, Sound Transit would be responsible for the remediation of any contaminated soil and groundwater, including any that is previously unknown and found during construction. To the extent practical, Sound Transit would limit construction activities that might encounter contaminated groundwater or contaminated soil.

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4.13 Electromagnetic Fields

4.13.1 Summary

In the FWLE study area, there are no sensitive facilities containing equipment susceptible to electromagnetic interference. While utilities can be affected by stray electric currents, avoidance measures are part of the project design. Therefore, there is no potential for electromagnetic field impacts in the study area.

4.13.2 Introduction to Resources and Regulatory Requirements

Electric and magnetic fields, known as electromagnetic fields (EMFs), are produced wherever electricity is used. Electric fields are produced by charges. Magnetic fields are created by the flow of electric current. The greater the electric charge, the greater the electric field. Similarly, the greater the electric current, the greater the magnetic field. EMFs are produced by electrical equipment and facilities, including electrical conveyance lines and electrical devices, and they can also be emitted with the movement of transportation vehicles, such as truck traffic.

Where there are electric currents, stray currents can occur when a portion of the electric current finds an alternative conducting path, such as metal, water, or a buried pipe or cable. Over time, a stray current can cause corrosion, which in turn can cause pipes to leak or wires to break. EMFs can also interfere with the functioning of sensitive equipment. These effects are known to the design and construction community. Utility lines are normally insulated and cathodic protection systems can be used to prevent corrosion damage.

4.13.3 Affected Environment

Although there are no regulatory requirements for EMFs, EMFs create electromagnetic interference (EMI), which can cause disruptions and possibly malfunction of some types of equipment. In certain situations with sufficiently high exposure, EMFs can also affect human health. The FWLE would not produce EMF levels that could affect nearby people, and therefore the EMF study area for FWLE depends on the location of sensitive equipment in relation to the light rail line and the amount of electrical power required to accelerate or decelerate light rail vehicles near sensitive facilities. However, the

potential for a light rail vehicle to adversely affect sensitive equipment from a distance greater than 100 feet is very low.

An exploration of land uses in the FWLE corridor included a search for existing and planned land uses where potential EMFs from light rail vehicles might interfere with normal operation and function of sensitive equipment. The survey of land uses noted whether there are research or medical facilities present that may use sensitive medical or laboratory equipment. The most noteworthy uses in the corridor include dental and medical facilities such as clinics and individual practice offices. None of these uses in the FWLE corridor are large enough to have equipment with high potential to be sensitive near a light rail facility, such as MRI, CAT scan, or laser equipment. Therefore, none of the clinics or medical/dental offices are expected to contain equipment with enough sensitivity to be affected by heightened EMFs. There are four medical facilities under construction or in operation where an interview with the owners was conducted to determine whether the facilities use or will use sensitive equipment. They are:

- **HealthPoint Midway Medical:** An existing community health clinic is at 26401 Pacific Highway South, Des Moines, WA 98198, which is located directly adjacent to SR 99.
- **Sea Mar Community Health Center:** A new community medical clinic is proposed at 24215 Pacific Highway South, Des Moines, WA 98918, on the property of the previous Des Moines Sea Mar facility and will be directly adjacent to SR 99. This project is under construction.
- **UW Medicine Neighborhood Clinic Federal Way:** An existing community medical clinic at 32018 23rd Avenue S, Federal Way, WA 98003, which is located between SR 99 and I-5.
- **UW Medicine Neighborhood Clinic Kent/Des Moines:** An existing community medical clinic at 23213 Pacific Highway South, Kent, WA 98032, which is located directly adjacent to SR 99.

Based on communications with each clinic, none of these clinics contain medical equipment sensitive to EMFs.

4.13.4 Environmental Impacts

4.13.4.1 No Build Alternative

If the FWLE is not built, then the existing EMF environment would not change.

4.13.4.2 Build Alternatives

The following subsections describe the direct and indirect impacts of the build alternatives. Construction impacts related to EMFs are discussed in Chapter 5, Construction Impacts.

Direct Impacts

Electromagnetic Fields

Since the clinics described in Section 4.13.3 do not contain sensitive medical equipment and no industrial or scientific facilities that contain sensitive equipment have been identified along the various alignments, the FWLE alternatives would have no interference with sensitive medical or electronic equipment. The electric current from the traction power substations carried by the catenary wires is a pulsating form of direct current, which can interfere with radio waves such as those used to transmit AM radio broadcasts. Many forms of electric charges can interfere with low-frequency radio waves, such as high-voltage power lines, trolley wires for electric buses, and hybrid cars. This interference can result in annoyance to the listener, but does not result in any damage to the radio equipment.

Stray Currents

Without control measures, a portion of the electrical current flowing through the light rail trains could stray to underground metallic objects, such as buried pipes, cables, or rebar. The current could then flow along conducting metallic lines in the ground back to the traction power substation or to nearby utilities. To avoid this issue, Sound Transit would coordinate control measures with the owners and operators of the utility lines that could be affected.

Sound Transit would minimize or avoid the potential for stray current impacts by selecting best management practices (BMPs) appropriate for the circumstances. The BMPs may include one or a combination of the following:

- Installing cathodic protection systems in nearby utility lines to protect them from corrosion
- Installing insulating unions to break the electrical conductivity of the pipe and thus force the stray current to take another path
- Isolating the electrical rails from the ground
- Installing stray-current-control track-fastening systems where appropriate, such as:

  - Tie-and-ballasted track using high-resistance track-fastening systems on concrete ties
  - Direct-fixation track using high-resistance, rubberized track-fastening systems
  - Embedded track using various methods of rail encapsulation such as rail coatings, polyurethane encasement, and rail boots

Cathodic protection system components include the following:

- Galvanic anodes
- Electrical isolation with insulating unions at connections to existing piping
- Pipe coatings
- Bonded mechanical pipe joints
- Permanent test facilities to monitor stray currents and rates of corrosion

Where tracks are elevated on overhead guideway structures, the return current cannot get to ground as easily as on structures that are not elevated; therefore, EMFs from overhead structures are less likely to affect underground utility lines.

Potential Health Effects from Light Rail Alternatives

EMFs can cause a variety of effects on humans. Certain EMF combinations can cause shock and burn injuries through direct contact with energized components; others can interfere with the operation of electrical and magnetic devices, including heart pacemakers. Based on data available from similar rail systems, operation of the light rail is unlikely to generate health impacts for riders or people along the tracks. Anticipated EMF intensities at locations of human exposure within and adjacent to the light rail line are considerably below exposure guidelines established by the American Conference of Governmental Industrial Hygienists and the more recent guidelines established by the International Commission on Non-Ionizing Radiation Protection. These guidelines address known biological effects and do not address speculative concerns about cancer and other possible health effects. Given uncertainties in potential biological effects, these guidelines do incorporate safety factors. Among the various alternatives, no notable differences exist in potential health impacts related to EMFs.

Indirect Impacts

There is no potential for indirect impacts because there are no sensitive equipment or facilities in the project study area.

4.13.5 Potential Mitigation Measures

No impacts were identified, and therefore no mitigation will be necessary.

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4.14 Public Services, Safety, and Security

4.14.1 Summary

The FWLE would not result in adverse impacts on public services because all alternatives are grade-separated from traffic and would not affect travel or response times for public service vehicles, including fire, emergency medical, and police. Access to the exclusive right-of-way, whether elevated, at-grade, or in a trench, would require additional coordination with fire and emergency medical services and police. A U.S. Post Office in Kent would need to be relocated for the Kent/Des Moines SR 99 East Station Option associated with both the SR 99 Alternative and the I-5 Alternative, as well as for the SR 99 to I-5 Alternative. Minor property acquisition or easements would be required from Mark Twain Elementary School and Federal Way High School properties, but would not affect operation of these schools. Property from a Highline College campus parking lot would be acquired for the Kent/Des Moines HC Campus Station Option for the SR 99 Alternative, and the Highline College Outreach Center on SR 99 would be displaced by the Kent/Des Moines SR 99 West Station and Kent/Des Moines HC Campus Station options. The Outreach Center would be relocated near or on the campus.

4.14.2 Introduction to Resources and Regulatory Requirements

This section discusses potential impacts from the FWLE on public services located within the study area or with service boundaries within the study area. These services include fire and emergency medical services (including hospitals), police, schools (public and private), solid waste and recycling collection, and mail delivery. This section also discusses project-related operations that could lead to increases or changes in emergency response services related to crime or other emergency response incidents. There are no regulatory requirements related to public services.

4.14.3 Affected Environment

The study area for public services is defined as a 0.5-mile boundary around the FWLE alternatives and includes the cities of SeaTac, Des Moines, Kent, and Federal Way. This section describes the locations and public service providers within the study area. Table 4.14-1 summarizes information on the public service providers within the

study area. Locations of facilities in the study area are shown on Exhibits 4.4-1 and 4.4-2 in Section 4.4, Social Impacts, Community Facilities, and Neighborhoods.

TABLE 4.14-1
Summary of Public Service Providers within Study Area

	Location			
	SeaTac	**Des Moines**	**Kent**	**Federal Way**
Police				
Local	SeaTac Police Department	Des Moines Police Department	Kent Police Department	Federal Way Police Department
County	King County Metro Transit Police King County Sheriff			
State	Washington State Patrol			
Fire/Emergency Medical				
Local	Kent Fire Department Regional Fire Authority	South King Fire & Rescue	Kent Fire Department Regional Fire Authority	South King Fire & Rescue
County	King County Medic One			
Solid Waste				
	Allied Waste Services	Recology Cleanscapes	Allied Waste Services	Waste Management
Schools				
Local School District	Highline School District	Highline School District	Kent School District	Federal Way School District
Private	Private schools are located throughout the study area.			
Post-Secondary	Highline College			
Other Government Facilities				
Federal Government Facilities	Federal Detention Center	U.S. Post Office	U.S. Post Office	None

Sources: City of SeaTac, 2013; City of Des Moines, 2013; City of Kent, 2013; City of Federal Way, 2013.

4.14.3.1 Fire and Emergency Medical Services

Fire and emergency medical services are provided by the Kent Fire Department Regional Fire Authority and South King Fire & Rescue. There are four stations located in the study area:

- SeaTac Fire Station 45, 2929 S 200th Street, SeaTac
- South King Fire & Rescue Station 26, 2238 S 223rd Street, Des Moines

- South King Fire & Rescue Station 66, 27010 15th Avenue S, Des Moines
- Kent Fire Station 73, 26512 Military Road S, Kent

There are no hospitals or emergency medical facilities located within the study area.

4.14.3.2 Police Services

There is a police substation located within the study area at 31620 23rd Avenue S in Federal Way, across from the Federal Way Transit Center (*Federal Way Mirror*, 2014). Sound Transit compared crime data for the cities in the study area with King County and Washington State to show the relative crime rates at the local, regional, and statewide levels. The crime reporting program provides statistics for violent crimes (i.e., murder, forcible rape, robbery, and aggravated assaults) and property crimes (i.e., burglary, larceny-theft, motor vehicle theft, and arson). Table 4.14-2 lists the numbers of offenses and crime rates by jurisdiction for 2011 and 2012, based on available data (Washington Association of Sheriffs and Police Chiefs, 2013, 2014).

TABLE 4.14-2
2011 and 2012 Violent and Property Crime Rates by Jurisdiction

Jurisdiction (Year)	Part 1 Offenses (Violent and Property Crimes)	Violent Crime Rate (per 1,000 Population)	Property Crime Rate (per 1,000 Population)
City of SeaTac (2012)	2,107	12.9	64.5
City of Des Moines (2011)	1,146	3.0	35.6
City of Kent (2012)	7,067	13.3	46.0
City of Federal Way (2011)	4,509	2.7	47.7
King County (2012)	6,721	4.0	21.9
Washington State (2012)	313,500	14.1	52.9

Source: Washington Association of Sheriffs and Police Chiefs, 2013, 2014.

Information was collected on criminal activity reported near Sound Transit's and King County's existing transit facilities located within the study area. Table 4.14-3 shows the number of violent and property crimes reported within 0.5-mile of these facilities between September 2011 and March 2013 (Crimereports.com, 2014).

TABLE 4.14-3
Violent and Property Crimes near Transit Centers and Park-and-Ride Lots within Study Area between September 2013 and March 2014

Owner	Location	Violent Crimes	Property Crimes
Sound Transit	Federal Way Transit Center	4	46
King County	Star Lake Park-and-Ride	14	15
King County	Redondo Heights Park-and-Ride	14	23
King County	S 320th Park-and-Ride	4	51

Source: CrimeReports.com, 2014.

4.14.3.3 Solid Waste Services

All nonhazardous solid waste collected in the study area is taken to transfer stations and then to the King County Cedar Hills Landfill in Maple Valley. The closest facility that accepts household hazardous waste is the South Transfer Station, managed by Seattle Public Utilities and located in Seattle.

4.14.3.4 Schools

There are 19 public and private primary and secondary schools located within the study area (Exhibits 4.4-1 and 4.4-2). These schools served approximately 9,900 students in the 2012-2013 school year. In addition, approximately 17,000 students attend Highline College (Highline College, 2014).

4.14.3.5 Other Government Facilities

Within the study area, other government facilities include a Federal Detention Center at 2425 S 200th Street in SeaTac and U.S. post offices at 23418 Pacific Highway S in Kent and 2003 S 216th Street in Des Moines.

4.14.4 Environmental Impacts

Sound Transit determined potential operational impacts on public services by reviewing design drawings to identify possible changes in the travel and response times for public service vehicles, including project elements that could alter access to public service facilities. Sound Transit qualitatively compared the crime rates of the cities within the study area with the overall crime rate of King County and performed a literature review associated with crime and light rail systems.

4.14.4.1 No Build Alternative

As a result of continued growth in population and employment in the study area, there would be increases in public services demands. In

addition, increases in traffic congestion could affect emergency services response times.

4.14.4.2 Build Alternatives

The following subsections describe the direct and indirect impacts of the build alternatives. Construction impacts related to public services are discussed in Chapter 5, Construction.

Direct Impacts

Impacts Common to All Alternatives

All of the build alternatives would have similar types of impacts on public services and safety and security.

Fire and Emergency Medical Services

Safety is one of the Sound Transit design criteria used to avoid conflicts with vehicular, bicycle, and pedestrian traffic. A safety and security management plan (SSMP) will be prepared for the FWLE. The SSMP establishes the safety and security organization required for the FWLE to integrate safety and security throughout the project life cycle (design, construction, and operation).

The FWLE would operate in its own (exclusive) right-of-way and would not conflict with vehicular traffic, bicycles, and pedestrians. Because light rail trains would not cross surface streets at grade, light rail operations would not directly affect emergency and incident response routes or times. Increased congestion at station areas and park-and-ride lots could affect response times, but traffic impacts would be mitigated. Chapter 3, Transportation Environment and Consequences, identified locations where traffic congestion and delays could occur with the FWLE alternatives.

All of the jurisdictions along the project corridor currently operate emergency vehicle preemption (EVP) programs that give emergency vehicles priority. Sound Transit would work with the jurisdictions to anticipate the EVP programming needs around stations and to ensure that emergency response times would not be affected.

Access to fire hydrants, fire lanes, and fire response access points within or adjacent to the FWLE boundaries would be maintained where possible; where it is not possible, access would be redesigned working with the appropriate agencies and jurisdictions. Fire department regulations and procedures prohibit placing fire hoses over active railroad tracks, so light rail operations could be temporarily shut down during fire emergencies.

Emergency incidents associated with the FWLE are expected to be minimal because the facilities would be made of noncombustible materials. The vehicles are electrically powered and do not use combustible fuels. Fire and emergency service vehicles would have to use different methods and, in some cases, different equipment, when responding to incidents associated with the different alternative profiles. Emergency service providers and Sound Transit personnel would be trained to respond to emergencies on elevated guideways or in trenches and restricted areas within Washington State Department of Transportation (WSDOT) right-of-way. Elevated and trench sections would be designed to provide emergency access and evacuation in conformance with state and local codes and with National Fire Protection Association (NFPA) 130: Standard for Fixed Guideway Transit Systems. Emergency vehicle access would be provided at approximately 2,500-foot intervals, consistent with NFPA 130. At these locations, emergency vehicles would be able to access the elevated, at-grade, and trenched light rail tracks. Where necessary to ensure that access is provided, new access points, such as bulb-outs and new access roads, would be created. Access to trains on elevated and trenched guideways could be provided via trains on the adjacent track. When a second train is not practical, Sound Transit would follow state and local fire codes and NFPA 130. Local fire departments in the study area have ladder trucks to properly respond to incidents on elevated structures.

A required component of the SSMP is the formation of the Fire/Life Safety Committee, which would review safety requirements and obtain concurrence from local authorities that have jurisdiction. The Fire/Life Safety Committee would develop solutions regarding access to the light rail system, emergency routes, water and fire hydrant needs, training, costs, and other design features. Sound Transit would continue to consult with local jurisdictions throughout FWLE design to minimize impacts on emergency response times. Implementing the required SSMP would minimize impacts on fire and emergency medical services during FWLE operation.

Police

Police vehicles traveling in the FWLE study area should not experience increased response times. Similar to fire and emergency medical responders, police vehicles could have difficulty in responding to calls at elevated sections of track or stations and to stations not easily

accessible from the existing roadway network, which would require additional planning between Sound Transit and local emergency providers.

All alternatives would create facilities where additional police and security staff would be needed to monitor stations, parking facilities, and other areas to protect people and property. Sound Transit operates its own security force at its facilities. Although an increase in crime at transit facilities is not anticipated, research from other transit systems shows that some petty crimes could occur at transit stations or park-and-ride lots. Studies have consistently found that crime at transit facilities, such as stations, generally reflects the conditions in the surrounding neighborhoods (Billings et al., 2011; City of Seattle, 1999; Loukaitou-Sideris et al., 2002). Quality of life crimes (for example, vandalism, drunkenness, and panhandling) and property crimes account for more than 90 percent of crimes at transit facilities. Violent crimes account for most remaining crimes. Crimes are more likely to occur at a station than on a light rail vehicle. In addition, stations with park-and-ride lots can have more potential for crime than stations without parking. Different types of station access (stairs, escalators, or elevators) do not appear to influence criminal activity, but their design and location can be a factor if they provide places where criminals can act without being observed by others.

Sound Transit would work with local authorities during final design to incorporate crime prevention through environmental design (CPTED) principles. The design of stations would be spacious, well-lit, uncluttered, and would provide open access. Attention would be given to lines of sight and visibility, with corners, dark or hidden areas, and opaque shelter screens eliminated or minimized. Public waiting areas, including station platforms, would be easily visible to other patrons and to police and Sound Transit security personnel. These methods, in association with other security features such as closed-circuit television cameras connected to the Link Control Center, passenger emergency telephones, sealed fare boxes, controlled exits, and security personnel would help to deter criminal activity and generally make light rail stations and parking facilities more secure. To address issues related to potential terrorist threats, Sound Transit will work with the Federal Transit Administration and local law enforcement agencies, the U.S. Department of Homeland

Security, and emergency service providers to develop strategies to prevent and respond to these potential threats.

Solid Waste

No adverse impacts on solid waste collection and disposal would occur during operation. The FWLE would not acquire any property currently occupied by recycling, composting, and solid waste facilities or operating bases. Collection routes would not be affected and would not experience delays resulting from minor changes in the existing roadways. Operation of the FWLE is not anticipated to result in a noticeable increase in the demand for solid waste services.

Schools

No FWLE alternatives would travel through neighborhoods with grade school-crossing zones. All of the alternatives include a station in the Kent/Des Moines area, which would improve access to Highline College. No adverse impacts related to school transportation are anticipated. Chapter 3, Transportation Environment and Consequences, explains that overall transit travel times would improve, which would improve the commute times for students and school staff commuting by transit.

Government Facilities

No adverse impacts are anticipated to postal collection or delivery and postal vehicles would not experience any delays resulting from changes to the existing roadways. The beginning of the FWLE is south of the Federal Detention Center in SeaTac and would have no impact on this facility.

Impacts by Alternative

SR 99 Alternative

The elevated guideway for the SR 99 Alternative would require placement of columns in the median of SR 99, which would not conflict with existing left-turn and u-turn movements.

The Kent/Des Moines SR 99 East Station Option would acquire the property where a U.S. Post Office is located at 23418 Pacific Highway S in Kent. The U.S. Postal Service has identified this post office for potential closure in the future (Puget Sound Business Journal, 2011). Sound Transit would work with the U.S. Postal Service to determine if this post office should be relocated and, if so, identify an appropriate location to serve this community.

The Kent/Des Moines HC Campus Station Option would locate the station on the Highline College campus, but it would be located in the current East Parking Lot and would not directly affect any college buildings. The parking displaced with this option would be replaced within a similar distance to the campus, potentially between the East Parking Lot and SR 99. In addition, parking for this station, along with the Kent/Des Moines SR 99 West Station, would displace the current Highline College Outreach Center at 23835 Pacific Highway S, which is a leased facility.

The SR 99 Alternative would acquire a portion of property from the Federal Way Public Schools associated with the east side of the Federal Way High School property for minor roadway improvements. No buildings or school uses would be affected because the alignment would be elevated in this area.

I-5 Alternative

The Kent/Des Moines SR 99 East Station Option would acquire the property where a U.S. Post Office is located at 23418 Pacific Highway S in Kent.

The I-5 Alternative alignment would travel under the playfields and driveway/bus loop at Mark Twain Elementary School at 2450 S Star Lake Road in Federal Way, south of the S 272nd Star Lake Station. The alignment would require an underground easement from this property, but no surface property is expected to be required. Although these playfields and the driveway loop would be closed temporarily during construction, they would be restored to existing conditions and no permanent impacts on the school facilities would occur. For further discussion, see Chapter 5, Construction.

SR 99 to I-5 Alternative

Potential impacts from the SR 99 to I-5 Alternative would be the same as for the SR 99 and I-5 alternatives where it follows those alignments. This alternative would acquire the property where a U.S. Post Office is located at 23418 Pacific Highway S in Kent.

I-5 to SR 99 Alternative

Potential impacts from the I-5 to SR 99 Alternative would include minor property acquisition from Federal Way High School for roadway improvements. No additional impacts would be associated with this alternative.

Indirect Impacts

The FWLE would not lead to an unplanned or induced increase in population, so it would not require additional public services beyond those already planned. The FWLE could result in focused population and employment redistribution within the station areas.

4.14.5 Potential Mitigation Measures

The Fire/Life Safety Committee and other Sound Transit safety and security specialists would continue to address public service issues throughout design, construction, and operation. Displaced public services would be relocated in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 and the Sound Transit Real Estate Property Acquisition and Relocation Policy, Procedures and Guidelines, as described in Sections 4.1.6 and 4.1.7. No additional mitigation would be needed.

4.15 Utilities

4.15.1 Summary

The Federal Way Link Extension (FWLE) alternatives would all have similar electrical requirements, and it is not anticipated that new electrical system capacity would be needed to accommodate the project. Alternatives or options with trenched areas would have more potential for long-term corrosion to underground utilities. This would be caused by underground stray electrical currents from electricity being transmitted from traction power substations (TPSSs) to the light rail system. This impact would be avoided through appropriate controls. No long-term adverse effects on existing utilities in the FWLE corridor would occur during operation of the FWLE. Most of the utility impacts would be due to construction activities (see Chapter 5, Construction Impacts).

4.15.2 Introduction to Resources and Regulatory Requirements

The relationship between transportation projects and utilities within the project corridor is regulated by state and local regulations and permitting processes. Local policies and procedures for the FWLE are administered by the cities of SeaTac, Des Moines, Kent, and Federal Way, as well as the Washington Administrative Code (WAC) 468-34, and by Washington State Department of Transportation (WSDOT) policies within WSDOT's right-of-way.

4.15.3 Affected Environment

The study area for utilities is defined as the area within 1/2 mile of the alternative alignments and stations. Sound Transit identified existing and planned utilities in the study area, including electrical power, natural gas, water, sanitary sewer, communications, and stormwater drainage systems. Information on existing utilities was obtained through database research and by contacting local municipalities and utility companies.

Although the FWLE would cross through the cities of SeaTac, Des Moines, Kent, and Federal Way, many of the utilities within the study area provide services in multiple jurisdictions. Table 4.15-1 summarizes the utility providers in each jurisdiction.

TABLE 4.15-1
Summary of Existing Utility Providers

Utility	SeaTac	Des Moines	Kent	Federal Way
Natural Gas	Puget Sound Energy			
Electricity	Puget Sound Energy			
Water	Highline Water District			Highline Water District Lakehaven Utility District
Sanitary Sewer	Midway Sewer District			Midway Sewer District Lakehaven Utility District
Stormwater	WSDOT, City of SeaTac	WSDOT, City of Des Moines	WSDOT, City of Kent	WSDOT, City of Federal Way
Communications	Century Link, Comcast, Level 3			

Sound Transit contacted utility providers to identify planned upgrades or new projects planned in the study area. The only planned utility improvement identified was a minor expansion of the Puget Sound Energy substation at S 221st Street.

4.15.4 Environmental Impacts

4.15.4.1 No Build Alternative

Under the No Build Alternative, the FWLE would not be constructed and no impacts on utilities within the study area would occur.

4.15.4.2 Build Alternatives

The discussion below addresses general impacts that would be common to all alternatives during operation of the FWLE. Impacts during operation include the utility demands of the operating light rail system. Most of the project impacts on utilities would be temporary and would be from construction activities rather than from operation. Temporary construction impacts on utilities, including relocations, are described in Chapter 5, Construction Impacts.

Direct Impacts

Long-term, direct impacts are common to all alternatives; there would be no operational impacts unique to any of the alternatives.

The FWLE light rail line would increase electricity usage in the study area because trains with up to four cars would operate on direct-current power taken from 26-kilovolt (kV) electric distribution facilities. Lighting installed at stations and safety lighting along the alignments, parking areas, and other light rail facilities would also increase electricity demand slightly. However, the FWLE would result in a slight regional reduction of passenger and transit vehicle miles traveled as people shift to the light rail system; therefore, overall

energy consumption would be less when compared to the No Build Alternative.

Electricity for operation of the FWLE light rail vehicles, stations, and facilities would be provided by Puget Sound Energy (PSE). The energy needed to power the FWLE light rail vehicles is less than 0.1 percent of the PSE 2011 power generation and is not expected to adversely affect the electric system or require that PSE develop additional energy resources. Sound Transit would coordinate with PSE to determine if improvements to any local substations would be necessary. Energy consumption rates are described in Section 4.10, Energy Impacts.

TPSSs would be located approximately every 2 miles to distribute power to the overhead catenary system (OCS). These stations would be powered by 26-kV electric lines connecting to the nearest power pole. Availability of power to each TPSS might, in some cases, require that additional distribution lines be constructed to the substation.

Underground utilities within or adjacent to the project footprint, including communications, gas, sewer, water, and electric lines, could be susceptible to corrosion from stray electrical currents traveling from the TPSS to OCS poles. The greatest potential for stray current impacts would occur in trenched areas of FWLE alternatives or options. Sound Transit would coordinate with utility providers to identify appropriate control measures, which could include:

- Installing cathodic protection systems
- Installing insulating unions to break the electrical conductivity of the utility
- Isolating electrical rails from the ground
- Installing stray-current-control track fastening systems where appropriate

Section 4.13, Electromagnetic Fields, provides additional discussion of the effects on utilities of stray currents from light rail vehicles. No substantial differences among build alternatives are expected in long-term utility service. Major service disruptions to utility customers during light rail repair and maintenance operations are unlikely. The light rail alignment would be designed so that access to utilities for maintenance and repair could be maintained. In some cases, sewer manholes, pipes, vaults, and other access points might have to be

relocated. Sound Transit would work closely with utility providers to maintain required access to these utilities and any relocated sewer holes and vaults, utility mains, fire hydrants, and other features.

Sound Transit would integrate efficient operating practices at existing and new facilities and use equipment to reduce energy and water demand and to recycle water. Implementing these and other sustainable practices would reduce consumption and demand on utilities.

Indirect Impacts

The improved transit access from the availability of light rail service would support planned development or redevelopment in the vicinity of the FWLE stations, which in turn could increase the demand for utility services in this area. Local governments have already planned for increased development in their adopted local land use plans and policies, consistent with regional plans. Furthermore, the project corridor is located entirely within the urban growth boundaries of the cities of SeaTac, Des Moines, Kent, and Federal Way, and any development near the FWLE would not be denser than what is allowed in the adopted land use plans of these cities. The indirect impacts on utilities should not be greater with or without the FWLE. See Section 4.4, Land Use, for more details on the indirect impacts related to land use development.

4.15.5 Potential Mitigation Measures

No long-term adverse impacts on utilities are anticipated, such as the need to develop additional capacity or transmission facilities to serve light rail operations; therefore, no mitigation is proposed.

4.16 Historic and Archaeological Resources

4.16.1 Summary

Within the FWLE area of potential effects (APE) for historic and archaeological resources, this analysis identified no archaeological resources. It identified eleven historic buildings that have been determined eligible for the National Register of Historic Places (NRHP).

The Kent/Des Moines Highline College (HC) Campus Station Option for the SR 99 Alternative would occupy the eastern edge of the Highline College parking lot, which would change a component of the setting of nine individually NRHP-eligible Highline College buildings. However, since the parking lot is not a contributing element to these historic buildings, this change would not constitute an adverse effect.

As a result of roadway widening, the SR 99 Alternative and the Federal Way SR 99 Station Option for the SR 99 Alternative would acquire part of the parcel occupied by the NRHP-eligible US Bank building. The area acquired is immediately adjacent to SR 99. The US Bank building is set back on the parcel and would not be physically impacted by the acquisition. Impacts to the building's setting would be minor and would not constitute an adverse effect. The Federal Transit Administration (FTA) has made a preliminary finding of "No Adverse Effects to Historic Properties" for the SR 99 Alternative.

Elements of the Federal Way I-5 Station Option for the I-5 Alternative and the SR 99 to I-5 Alternative would be located approximately 152 feet from the NRHP-eligible Calvary Lutheran Church, but would not affect the church or its setting. FTA has made a preliminary finding of "No Historic Properties Affected" for the I-5 Alternative, the SR 99 to I-5 Alternative, and the I-5 to SR 99 Alternative.

Alternatives that would acquire parts of parcels with NRHP-eligible buildings may result in "*de minimis*" use of historic properties under Section 4(f) of the Department of Transportation Act. Appendix E includes a Section 4(f) analysis and preliminary determination.

***De Minimis* Impacts**

De minimis impacts cannot "adversely affect the activities, features, and attributes" of a Section 4(f) resource. For historic and archaeological sites, a *de minimis* impact is allowed if FTA has determined "no adverse effect" in compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). When FTA has made a *de minimis* determination, the project is not required to analyze avoidance alternatives for that Section 4(f) property.

4.16.2 Introduction to Resources and Regulatory Requirements

The two main federal laws protecting historic and archaeological resources are the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). "Historic properties" are defined in NHPA's regulations as any prehistoric or historic district, site, building, structure, or object included in or eligible for the NRHP. Cultural resources must also be given consideration under NEPA. In addition, for U.S. Department of Transportation projects, Section 4(f) of the U.S. Department of Transportation Act protects NRHP-eligible properties.

Applicable state laws and authorities include the Washington State Environmental Policy Act (SEPA) and laws and regulations relating to cultural and archaeological resources. These include the Washington Heritage Register (WHR) program (administered by the Department of Archaeology and Historic Preservation [DAHP]). Under Washington state law, any alteration to an archaeological site requires a permit from DAHP. State law also protects Native American burial sites.

Properties within unincorporated areas of King County may be designated and protected as King County landmarks under the King County Historic Preservation Program by the King County Landmarks Commission. This Commission also acts as a municipal landmarks board for cities (including Des Moines and Kent) that have entered into interlocal agreements with the County for historic preservation services. A historic resource may be designated as a King County Landmark if it is more than 40 years old or, in the case of a landmark district, contains resources that are more than 40 years old. This differs from NRHP criteria, which require that a property be 50 years old unless it is exceptionally important. The King County Landmarks Commission determines if a property is eligible as a King County Landmark. Discussions of potential King County Landmark eligibility in this Draft EIS are recommendations only, based on a review of the King County Landmarks Commission ordinance. There are no designated King County Landmarks in the APE.

Laws and Authorities that Protect Historic and Archaeological Resources

National Historic Preservation Act of 1966, as amended (54 U.S. Code [U.S.C.] 300101)

Protection of Historic Properties (36 CFR 800)

National Environmental Policy Act of 1969 (42 U.S.C. § 4321)

Section 4(f) of the U.S. Department of Transportation Act (23 CFR 774)

Washington State Environmental Policy Act (Chapter 43.21C Revised Code of Washington [RCW])

Washington Heritage Register (27.34.200 RCW)

Indian Graves and Records (RCW 27.44)

Archaeological Sites and Resources (RCW 27.53)

King County Landmarks Commission ordinance (King County Code 20.62)

Eligibility Criteria for the National Register of Historic Places

- Criterion A: Associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: Associated with the lives of persons significant in our past; or
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D: Yielded, or may be likely to yield, information important in prehistory or history.

4.16.3 Affected Environment

The Historic and Archaeological Technical Report (Appendix G4) includes a history of the FWLE study area, additional information about federal, state, and local regulations affecting cultural resources, and further detail regarding the NRHP-eligible resources described in the following sections. It also includes information on each of the parcels inventoried as part of the built environment survey.

4.16.3.1 Archaeology

The FWLE APE for archaeology includes areas that would experience ground disturbance within 200 feet of the guideway centerline, and within 200 feet of the edge of ground disturbance for stations and other ancillary facilities. On December 30, 2013, DAHP concurred with FTA on this APE. The study area used for the archaeology literature review is a 0.5-mile radius of the project alternative centerlines. This is larger than the APE to provide greater context for the type of historic properties that may be encountered within the APE. A file search using DAHP's Washington Information System for Architectural and Archaeological Records Data (WISAARD) database on June 10, 2014, showed that there were 10 previous cultural resource studies in the 0.5-mile study area, but no recorded archaeological resources within the APE. A limited reconnaissance-level survey was conducted for publicly owned parcels that were accessed for the wetland survey. No archaeological sites were recorded or encountered during the survey.

The DAHP archaeological predictive model identifies some areas within the APE as high probability areas. These areas are primarily along the SR 99 corridor or concentrated near stream drainages, and are shown in Appendix G4. This information will be used to target areas for archaeological investigation after the Preferred Alternative is identified. More information is provided in Appendix G4.

4.16.3.2 Traditional Cultural Properties

With support from Sound Transit, FTA is conducting government-to-government consultation with the Yakama Nation, Muckleshoot Indian Tribe, Puyallup Tribe of Indians, Snoqualmie Indian Tribe, Stillaguamish Tribe of Indians, and Suquamish Tribe about the project and its potential effects on archaeological sites and traditional cultural properties (TCPs). Sound Transit and FTA also initiated consultation under Section 106 with the non-federally-recognized

Duwamish and Snohomish tribes. Consultation with the tribes, which began in June 2013, has revealed no TCPs in the project vicinity.

4.16.3.3 Built Environment

The FWLE APE for the built environment generally extends 200 feet from the edge of each alternative's long-term footprint, including guideways, stations, parking, ancillary facilities, and road improvements. The standard NRHP age threshold for significance is 50 years. Sound Transit used 1970 as the threshold year to capture all properties that will be 50 years old at the time the project is likely to be acquiring and demolishing structures in the project right-of-way. On December 30, 2013, DAHP concurred with FTA on the APE.

Literature Review

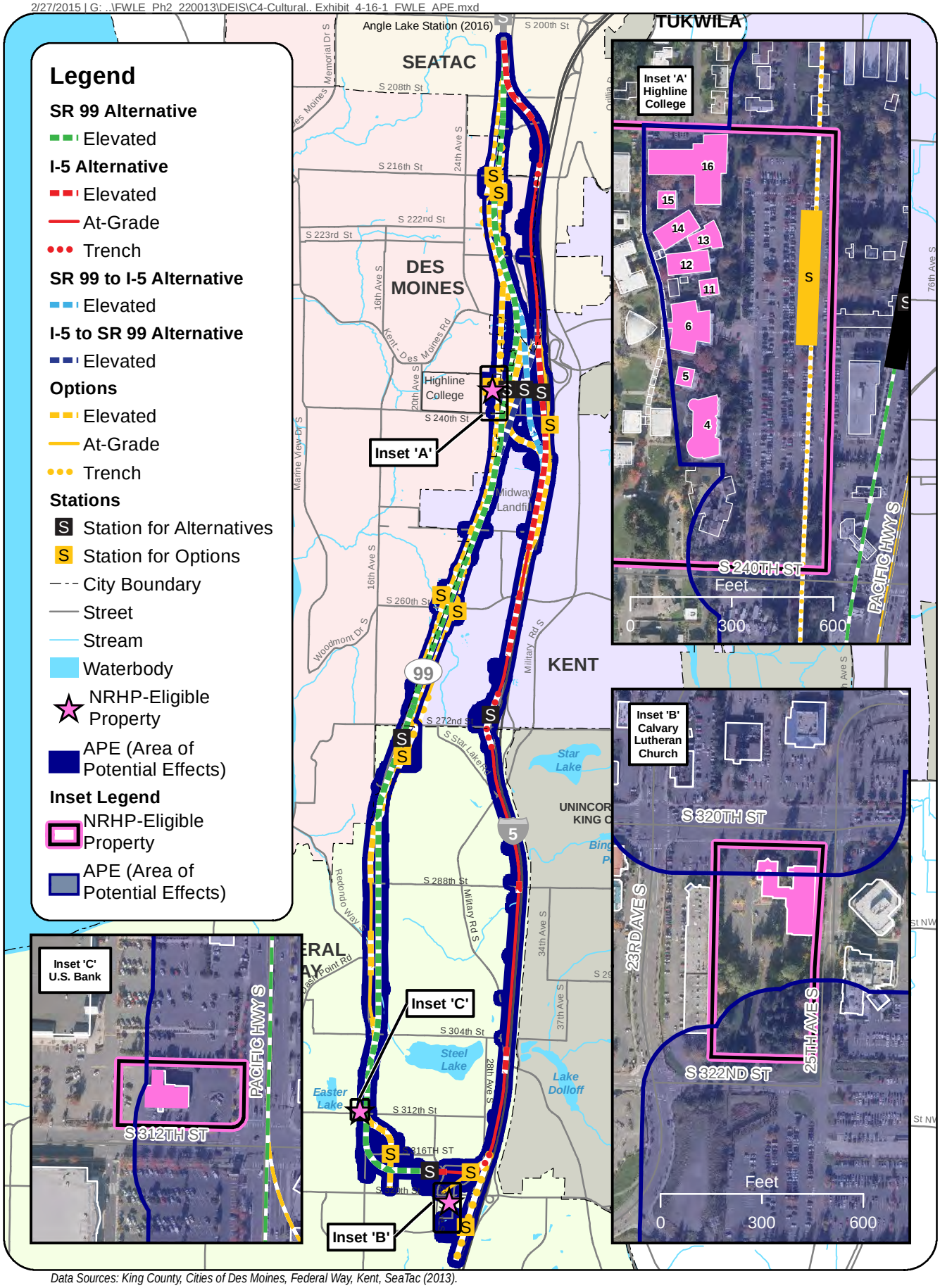
A literature search indicated that there are no NRHP- or WHR-listed built-environment resources and no designated King County Landmarks in the APE. Nine buildings along the eastern edge of the Highline College campus are located more than 200 feet from any project component; however, Sound Transit expanded the APE to encompass them to ensure potential effects were evaluated. Four of the buildings (Buildings 4, 5, 6, and 11; see Inset A of Exhibit 4.16-1) were previously determined eligible for the NRHP under Criterion C in 2013 and therefore are also eligible for the WHR.

Field Survey

There are 388 parcels in the APE with buildings built before 1971. They include a mix of commercial and residential properties that were constructed between 1910 and 1970. Three parcels contain historic buildings that are eligible for listing in the NRHP/WHR. One contains the majority of the Highline College campus in Des Moines, including the nine historic buildings on the eastern side of the campus that are within the APE. The other two parcels are the sites of Calvary Lutheran Church and the US Bank building, both in Federal Way.

Findings of Eligibility

In consultation with DAHP, FTA determined that the following buildings are eligible for listing in the NRHP: the five Highline College buildings that had not previously been found eligible; Calvary Lutheran Church; and the US Bank building (Table 4.16-1). Buildings 4, 5, 6, and 11 were determined eligible for the NRHP in 2013. All other surveyed properties were determined not eligible. DAHP concurred with these determinations on March 14 and December 24, 2014. Additional information on these buildings is provided below. Exhibit 4.16-1 shows their locations.



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.5 1 2 Miles

EXHIBIT 4.16-1
Location of Historic Properties in the APE

Federal Way Link Extension

TABLE 4.16-1
NRHP-Eligible Properties within the APE

Building Name	Date of Construction
Highline College Building 4	1964
Highline College Building 5 (Faculty Building)	1964
Highline College Building 6 (Student Union)	1964
Highline College Building 11 (Faculty Building)	1964
Highline College Building 12	1964
Highline College Building 13	1964
Highline College Building 14	1964
Highline College Building 15	1967
Highline College Building 16	1967
Calvary Lutheran Church	1956, 1968
US Bank	1960

Notes:
All Highline College buildings are located at 2400 S 320th Street, Des Moines. Calvary Lutheran Church is located at 2415 S 320th Street, Federal Way. US Bank is located at 1436 S 312th Street, Federal Way.
All Highline College buildings appear to meet King County Landmark Status designation criteria.

All nine buildings on the Highline College campus are recommended as meeting the King County landmark designation criteria.

Highline College

Highline Community College was founded in 1961 and established at its current Des Moines location in 1963. The college's name was changed to Highline College in 2014. Ralph H. Burkhard (1908-1993) was the architect for the original college buildings. Burkhard received numerous awards and was known for his educational buildings and unusual techniques, and he continued his innovative designs at Highline College. In 1966, the American Association of School Administrators gave the campus an award for exceptional design. As noted above, the campus contains six buildings that were previously determined eligible for the NRHP under Criterion C for their architectural significance (Buildings 4, 5, 6, 11, 19, and 28; Buildings 19 and 28 are well outside the project's APE), and FTA determined that five more buildings are eligible (Buildings 12, 13, 14, 15, and 16). Buildings 4, 5, 6, 11, 12, 13, 14, 15, and 16 are located in a row along the eastern side of the Highline College campus. All are individually eligible under Criterion C for their architectural significance as examples of 1960s-era tilt-up construction.

The NRHP/WHR eligibility determinations are limited to the individual buildings and do not include the surrounding campus, which is quite large and contains numerous non-historic buildings and structures.

Highline College Building 4, West Elevation

Highline College Building 5, Northwest Corner

Highline College Building 6, West Elevation

Highline College Building 11, Southwest Corner

Highline College Building 12, Northeast Elevation

Highline College Building 13, West Elevation

Highline College Building 14, North Elevation

Highline College Building 15, West Elevation

Highline College Building 16, Northeast Elevation

Calvary Lutheran Church

First established in 1954, the Calvary Lutheran Church is composed of the original church, which is now a classroom building, and a larger sanctuary constructed in 1968. The 1968 sanctuary, designed by the Seattle firm of Steinhart, Theriault & Anderson, is a good example of the Neo-Expressionist architectural style with its exaggerated, tall, hipped roof and flared eaves. The property has undergone several additions and renovations that have diminished the integrity of the 1954 building. However, the 1968 sanctuary retains much of its integrity and is eligible for listing in the NRHP/WHR under Criterion C for its architectural significance.

Calvary Lutheran Church, North Elevation

Seven Aspects of Integrity

Setting, feeling, association, location, materials, design, and workmanship

US Bank Building

The US Bank building, constructed in 1960, employs certain materials and design elements that were commonly used in the 1950s and 1960s, making it a good example of mid-century architectural design.

The defining characteristics of the building include the glass curtain wall on the building's front (south) elevation, the flat roof, and the brick veneer walls with decorative honeycomb brickwork on the west elevation. Other features of the building, such as the drive-through banking overhang, are utilitarian features common to bank buildings of the era. The original brick veneer has been painted and a small glass enclosure for the ATM machine was added on the front elevation. However, the building retains integrity overall. The building is eligible for listing in the NRHP/WHR under Criterion C for embodying distinctive characteristics of mid-century modern commercial architecture.

US Bank, Southwest Corner

4.16.4 Environmental Impacts

This section discusses long-term impacts of the FWLE on historic resources. Section 5.2.17 of Chapter 5 addresses potential impacts to and treatment of archaeological sites encountered before or during construction.

Section 106 regulations allow three findings for effects on historic properties:

- No Historic Properties Affected
- No Adverse Effect
- Adverse Effect

FTA makes a determination of effect for each property potentially affected. Once a Preferred Alternative is identified, FTA makes an overall finding of effect for the undertaking (i.e., the project as a whole) and requests the DAHP's concurrence.

4.16.4.1 No Build Alternative

The No Build Alternative would not affect any historic properties.

4.16.4.2 Build Alternatives

Direct Impacts

Research and initial surveys have not identified any NRHP-eligible archaeological sites within the APE. After the Sound Transit Board identifies a Preferred Alternative, more detailed field survey work will likely be performed.

Table 4.16-2 summarizes each alternative's potential effects on NRHP/WHR-eligible buildings. Following the table are discussions of the impacts of each alternative. There is no discussion of the I-5 to

SR 99 Alternative because that alternative has no historic properties within its APE.

TABLE 4.16-2
Historic Properties and Findings of Effect

Property Name	Alternative	Proximity to the Alternative	Potential Impact	Section 106 Finding[a]
Highline College Building 4	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	206 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 5 (Faculty Building)	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	277 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 6 (Student Union)	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	249 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 11 (Faculty Building)	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	233 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 12	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	249 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 13	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	215 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 14	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	289 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 15	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	362 feet	Minor alteration to Setting	No Adverse Effect
Highline College Building 16	Kent/Des Moines HC Campus Station Option to the SR 99 Alternative	210 feet	Minor alteration to Setting	No Adverse Effect
Calvary Lutheran Church	Federal Way I-5 Station Option to the I-5 Alternative and to the SR 99 to I-5 Alternative	152 feet	None	No Historic Properties Affected
US Bank	SR 99 Alternative and Federal Way SR 99 Station Option to the SR 99 Alternative	172 feet	Minor alteration to setting	No Adverse Effect

[a] FTA's preliminary determination.

SR 99 Alternative

The Kent/Des Moines HC Campus Station Option for the SR 99 Alternative includes a light rail station plaza located within the Highline College campus parking lot. The plaza's edge would be approximately 206 feet from the nearest eligible building. The station

would be in an open trench on the eastern edge of Highline College's east parking lot. The addition of the station would be noticeable, but the changes to the setting of the nine eligible buildings (Buildings 4, 5, 6, 11, 12, 13, 14, 15, and 16) would be minimal. While the parking lot is part of the visual area of the adjacent historic buildings, it is not historic and is not a contributing component of the historic buildings. The eligible buildings face west, oriented away from the parking lot and towards the interior of the campus. In addition, because the buildings are located on a lower grade than the existing parking lot, at the bottom of a small slope, they are visually separated from the parking lot and potential station location. The above-grade improvements required to construct the station would not physically alter the buildings. Thus, the minor impacts to their setting would not affect the aspects of integrity that qualify the nine Highline College buildings for listing in the NRHP/WHR and the option would result in no adverse effect to historic properties.

For the SR 99 Alternative and the Federal Way SR 99 Station Option for the SR 99 Alternative, Sound Transit would acquire part of the parcel on which the US Bank building is located. However, no physical changes would affect the NRHP-eligible building. The US Bank building is set back on the parcel lot, approximately 172 feet west of the project alternative. The east elevation of the building, which faces Pacific Highway S, is a side elevation clad in brick veneer with a service entrance but no other fenestration. Notable character-defining features of the building include the decorative honeycomb brickwork on the west elevation and the glass curtain wall on the building's front (south) elevation. These features do not face Pacific Highway S and would not be materially affected by the project. Currently, a large paved parking lot creates a barrier between Pacific Highway S and the historic building. Removing a narrow sliver of this parking lot would be a minor impact to the setting of the building, and it would not compromise any aspects of the building that qualify it as eligible for the NRHP/WHR. Therefore, the SR 99 Alternative and Federal Way SR 99 Station Option would result in no adverse effect to the property.

I-5 Alternative and SR 99 to I-5 Alternative

The Federal Way I-5 Station Option for the I-5 Alternative and for the SR 99 to I-5 Alternative would have no impact on the Calvary Lutheran Church. The station plaza would be partially in a trench and partially at-grade approximately 518 feet away from the historic

property. The parking lot and a tail track would be across S 320th Street and approximately 152 feet from the church. The location already experiences the visual and noise effects of heavy street traffic, and FWLE operations would cause no additional impacts. Therefore, no changes to the church's setting would occur and the station option would result in no historic properties affected.

Indirect Impacts

The project alternatives would have no indirect impacts on the eligible Highline College buildings, Calvary Lutheran Church, or US Bank building.

Section 4(f) Applicability

Section 4(f) addresses three types of use: (1) the permanent incorporation of land into a transportation facility, (2) a temporary occupancy of land that is adverse in terms of the statute's purposes, and (3) proximity impacts such that they impair important features or characteristics of the property (a "constructive use"). Section 4(f) also recognizes a *de minimis* impact, which is when there is only a minor impact to the resource. FTA has made a preliminary finding that only the SR 99 Alternative and the Federal Way SR 99 Station Option for the SR 99 Alternative would use a historic property under Section 4(f).

The project's potential Section 4(f) use of historic properties is limited to partial acquisitions of parcels where eligible buildings are located. Under the SR 99 Alternative Kent/Des Moines HC Campus Station Option, the FWLE would occupy part of a campus parking lot. The large parcel holds most of the Highline College campus, including the east parking lot and the historic buildings in the APE. The east parking lot does not contribute to the historic buildings in the APE.

The SR 99 Alternative, I-5 to SR 99 Alternative, and Federal Way SR 99 Station Option would acquire a narrow strip of the US Bank property for road widening adjacent to SR 99. The acquisition of this land would not affect the physical integrity of NRHP-eligible buildings and would have at most a minor effect on the buildings' setting. FTA's preliminary determination is that these potential effects would be *de minimis* use of historic properties.

There is no constructive use under Section 4(f) because the project's proximity impacts do not substantially impair any historic properties. See Appendix E for more information about Section 4(f).

4.16.5 Potential Mitigation Measures

No known archaeological sites are located in the APE. The project's operations would not have adverse effects to historic properties. Therefore, no long-term mitigation measures are required. Because construction could encounter unknown archaeological resources, Sound Transit will implement construction mitigation measures as described in Section 5.2.17.2.

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4.17 Parkland and Open Space

4.17.1 Summary

Seven existing parks or recreation facilities are located within the FWLE study area for parkland and open space. The Federal Way SR 99 Station Option, associated with the SR 99 Alternative and the I-5 to SR 99 Alternative, would acquire 0.7 acre of Federal Way Town Square Park for a transit connection between the station and the Federal Way Transit Center. The affected area consists of parking and landscaping, and no recreational uses at the park would be impacted. The project would not affect any other parks. Playfields at Mark Twain Elementary School would be temporarily affected during construction by the I-5 Alternative and SR 99 to I-5 Alternative, but no long-term impacts would occur (see Chapter 5). Appendix E includes a Section 4(f) analysis and preliminary determination.

4.17.2 Introduction to Resources and Regulatory Requirements

The FWLE parkland and open space study area includes several recreational facilities in Des Moines, Kent, and Federal Way that vary in size, type, and function. There are no parks or recreational resources in the portion of the study area located inside the city of SeaTac.

Section 4(f) of the U.S. Department of Transportation Act applies to U.S. DOT projects, including the FWLE. It protects “publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance.”

4.17.3 Affected Environment

Parkland and open space resources include public parks, greenbelts, and other undeveloped open spaces, recreational pedestrian and bicycle trails, playfields, and school district play areas that are available for public use during non-school hours. The study area for parks and other recreational resources for FWLE consists of resources located within approximately one block (250 feet) of the alternatives, staging areas, and ancillary facilities, as well as resources located within 0.25 mile (approximately 1,320 feet) of stations. Typically, impacts on recreational resources occur within these distances. An exception to the study area boundary is the area on the east side of I-5. The project would not affect any parks east of the freeway.

Most of the resources in the study area are owned or maintained by the parks and recreation departments of the cities of Des Moines, Kent, and Federal Way. Table 4.17-1 summarizes information about the seven existing local park and recreational resources in the study area.

The cities of Kent and Federal Way have generally identified possible future parks in their local planning documents that could be within the study area, but they have not defined specific locations. In addition, city zoning requirements in the corridor may result in additional parks or public open space as part of private residential and mixed-use developments in the future.

Exhibit 4.17-1 shows the study area and existing parks/recreation areas.

4.17.4 Environmental Impacts

Direct long-term impacts typically include permanent changes to a resource, such as when a project converts land from a park or recreational resource to another use. Indirect long-term impacts could include changes to the area surrounding the park or recreational resource that would affect recreational opportunities or the recreational experience. Indirect long-term impacts could also include improved access to park and recreational facilities. While long-term impacts generally refer to permanent changes, some construction impacts can be considered long-term if they would have a major effect on the resource and extend for years.

Potential impacts were identified based on the definitions above and the current use of the park and/or open space resource in the study area. Planned parks were not evaluated for long-term impacts because specific locations and designs have not been developed.

4.17.4.1 No Build Alternative

The No Build Alternative would not directly or indirectly affect any park or open space resource in the study area.

TABLE 4.17-1
Park and Recreation Resources in the FWLE Study Area

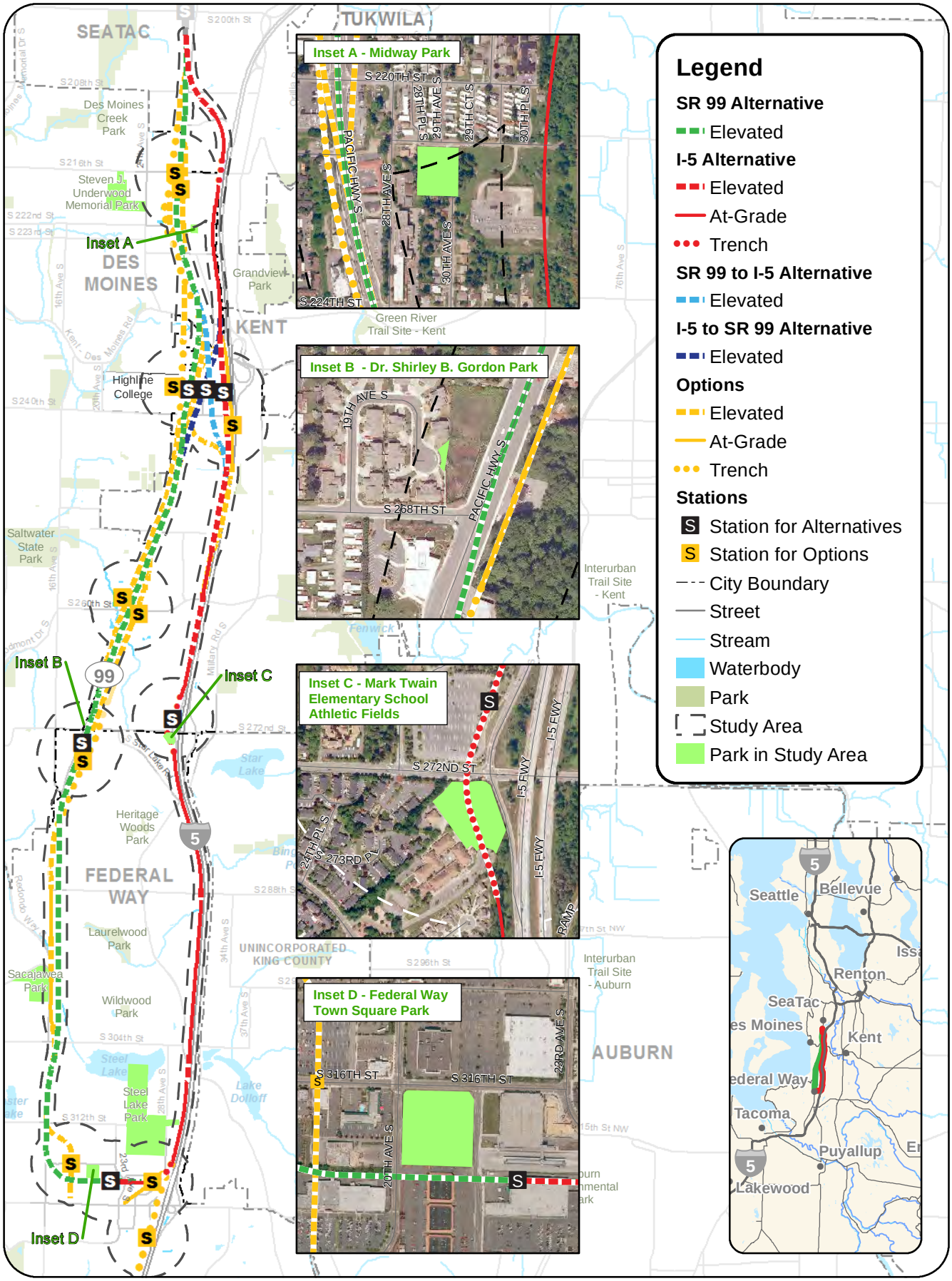
Resource Name	Size (acres)	Type and/or Function	Facilities	Ownership	Corridor
Steven J. Underwood Memorial Park	20.5	Community park	Three lighted softball fields	City of Des Moines	SR 99
Midway Park	1.6	Community park	Play area, picnicking areas, basketball hoops, and a walking path	City of Des Moines	SR 99
Dr. Shirley B. Gordon Park	0.9	Community park	Playground and open space	City of Des Moines	SR 99
Sacajawea Park	18.0	Community park	Two lighted baseball fields, a tennis court, a soccer field, a football field, a 440-yard track, walking pathways, a playground, and restrooms	City of Federal Way	SR 99
Mark Twain Elementary School Playfields	1.7	School athletic field	Playfield for softball and soccer	Federal Way Public Schools	I-5
Steel Lake Park	52.0	Community park	Beach, swimming area, boat launch, a sand volleyball pit, horseshoe pits, a concession building, restrooms, playgrounds, five picnic areas, open lawn areas, a trail, parking	City of Federal Way	SR 99 and I-5
Federal Way Town Square Park	4.1	Community park	Park with labyrinth, basketball courts, open lawn area, p-patch, chess boards, picnic area; future plans for seating area and stage	City of Federal Way	SR 99 and I-5

4.17.4.2 Build Alternatives

This section describes the direct and indirect impacts of the build alternatives. Construction impacts related to parkland and open space are discussed in Chapter 5. Table 4.17-2 summarizes each alternative's potential for direct and indirect impacts on parklands.

Direct Impacts

Long-term adverse effects on parks would occur only with the Federal Way SR 99 Station Option, which would affect Federal Way Town Square Park. This station option would convert 0.7 acre of the park's parking lot and landscaping to a new transit-only roadway. The park's parking lot would remain operational, but the roadway would remove approximately 30 of 140 parking spaces. Recreational resources such as the park's labyrinth, basketball courts, open lawn area, p-patch, chess boards, and picnic area would not be affected.



Data Sources: King County, Cities of Des Moines, Federal Way, Kent, SeaTac (2013).

N

0 0.5 1 2 Miles

EXHIBIT 4.17-1
Parks

Federal Way Link Extension

TABLE 4.17-2
Summary of Potential Park Impacts

Alternative	Parks in Study Area	Direct Impacts	Indirect Impacts
SR 99	Steven J. Underwood Memorial Park, Midway Park, Dr. Shirley B. Gordon Park, Sacajawea Park (only in the study area for the S 272nd Redondo Trench Station Option), Steel Lake Park, Federal Way Town Square Park	The Federal Way SR 99 Station Option would convert 0.7 acre of the Federal Way Town Square Park for a transit connection between the new station and the Federal Way Transit Center. Affected areas include parking and landscaping, but would not include any areas used for recreation. No adverse effects on recreational resources would occur.	No adverse impacts. Accessibility would increase at the following parks within 0.25 mile of a station or potential additional station: Steven J. Underwood Memorial Park, Midway Park, Steel Lake Park, and Town Square Park, where access would be improved with the SR 99 Alternative Federal Way Transit Center Station and the Federal Way SR 99 Station Option.
I-5	Steel Lake Park, Mark Twain Elementary School playfield, Federal Way Town Square Park	No adverse effects on recreational resources would occur. Temporary impacts at Mark Twain Elementary School are described in Chapter 5, Construction.	No adverse impacts. Accessibility would increase at Steel Lake Park and Town Square Park with the I-5 Alternative Federal Way Transit Center Station because they would be within 0.25 mile of a station. Other station options would not increase accessibility to these parks.
SR 99 to I-5	Steel Lake Park, Mark Twain Elementary School playfields, Federal Way Town Square Park	Same as I-5.	Same as I-5.
I-5 to SR 99	Dr. Shirley B. Gordon Park, Sacajawea Park, Steel Lake Park, Federal Way Town Square Park	Same as SR 99.	No adverse impacts. Accessibility would increase at Steel Lake Park and Town Square Park with the I-5 Alternative Federal Way Transit Center Station because these parks would be within 0.25 mile of a station. Other station options would not increase accessibility to these or other parks in the study area.

Indirect Impacts

Indirect long-term impacts to parkland and open space generally include changes to the area surrounding a park that would affect the recreational experience, such as increased noise levels near parks that are noise-sensitive. The parks in the FWLE study area were evaluated for sensitivity to noise, based on the types of park uses. As discussed in Section 4.7, Noise and Vibration, none of the parks in the study area are considered noise-sensitive, and no adverse noise or vibration impacts would occur. As discussed in Section 4.5, Aesthetic Resources, no visual impacts on parks would occur.

Parks that are within 0.25 mile of a station would benefit from enhanced access because people could walk from the light rail station to parks within this distance. The The SR 99 Alternative would have the most benefits because it has the most parks near station areas.

Section 4(f) Applicability

The only park directly affected by the project would be Town Square Park; this park's parking lot and landscaping would be impacted by the Federal Way SR 99 Station Option. Consultation with the City of Federal Way, which owns and maintains the property, is ongoing. This park is considered a Section 4(f) property. FTA anticipates that if that station option were part of the preferred alternative, the nature of the impacts would warrant a "*de minimis* impact" finding under Section 4(f) regulations. This is a determination that the project would not adversely affect the activities, features or attributes qualifying the park for protection under Section 4(f). The City of Federal Way must agree with this conclusion for FTA to make such a finding.

***De Minimis* Impacts**

De minimis impacts cannot "adversely affect the activities, features, and attributes" of a Section 4(f) resource. For public parks or recreation properties, a de minimis impact finding requires written concurrence from the agency with jurisdiction over the property. When FTA has made a de minimis determination, the project is not required to analyze avoidance alternatives for that Section 4(f) property.

As discussed in Chapter 5, Construction, the Mark Twain Elementary School playfield would be temporarily affected by construction of the I-5 Alternative and SR 99 to I-5 Alternative. The playfield is used outside of school hours by community youth softball, baseball, and soccer leagues, primarily as a practice field. Consultation with Federal Way Public Schools, which owns and maintains the property, is ongoing. Given the nature of non-school uses at the playfield, and the school district's ability to provide for these recreational functions at other facilities, FTA's preliminary determination is that the playfield is not a "recreation area of national, State, or local significance" and therefore is not a Section 4(f) property. Federal Way Public Schools concurred with this finding on December 30, 2014. See Appendix E, Draft Section 4(f) Evaluation, for more information on Section 4(f) impacts.

4.17.5 Potential Mitigation Measures

To mitigate long-term impacts on parks and open space, Sound Transit would provide replacement lands, park enhancement, and/or financial compensation, where appropriate. Lost parking at Town Square Park would be mitigated with replacement parking at or near the park, or by monetary compensation.