Chapter 7: Indirect and Cumulative Effects

This chapter describes indirect and cumulative effects expected to be associated with the proposed SR 520, I-5 to Medina: Bridge Replacement and HOV Project. The Indirect and Cumulative Effects Discipline Report (included in Attachment 7) details analytical methods and other past, present, and reasonably foreseeable future actions that could add to or interact with the direct and indirect effects of the project to produce cumulative effects. WSDOT does not mitigate cumulative effects because it does not have jurisdiction over the many non-WSDOT projects that contribute to them (WSDOT, FHWA, and EPA 2008). However, WSDOT is required to disclose cumulative effects and to suggest practical mitigation options that could be taken by the responsible parties. Consequently, this chapter suggests ways that public agencies and private developers beyond WSDOT's jurisdictional responsibilities could mitigate cumulative effects. For more information, see the Indirect and Cumulative Effects Discipline Report.

7.1 What are indirect and cumulative effects?

Indirect effects (sometimes called secondary impacts or effects) are defined as effects that:

> ... are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR 1508.8)

Indirect effects result from one project but, unlike direct effects, typically involve a chain of cause-and-effect relationships that can take time to develop and can occur at a distance from the project site. This makes some indirect effects difficult to predict accurately, although they must be reasonably foreseeable, and usually requires a qualitative estimate more general than predictions of direct effects.

Cumulative effects (also called cumulative impacts) are defined as:

> ... the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7)

A cumulative effect is the project's direct and indirect effects on a particular resource combined with the past, present, and future effects of other human activities on that same resource. The result is the expected future condition of the resource when all of the external factors known or likely to affect it are taken into account.

7.2 Why are indirect and cumulative effects considered in an EIS?

Federal regulations (40 CFR 1502.16, 1508.7, 1508.8) require that indirect and cumulative effects be considered in an EIS because they inform the public and decision-makers about possible unintended consequences of a project that are not always revealed by examining direct effects alone. This information places the proposed action in context with other development and transportation improvement projects planned throughout a region, and provides a brief assessment of each resource's present condition and how it is likely to change in the future as a result of the cumulative effect.

7.3 How did WSDOT identify and evaluate indirect effects?

To identify and evaluate potential indirect effects of the project, WSDOT followed Section 412 of the WSDOT *Environmental Procedures Manual* and FHWA Technical Advisory T 6640.8A*, Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (FHWA 1987). These provide general guidance for identifying, evaluating, and documenting indirect effects of transportation projects. More specifically, WSDOT followed an eight-step approach recommended in the *Environmental Procedures Manual* and in FHWA's Indirect Effects Analysis Checklist (FHWA 2009). This approach is presented in National Cooperative Highway Research Program (NCHRP) Report 466, Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (Louis Berger Group Inc. 2002). Table 7-1 summarizes the eight-step approach for assessing indirect effects.

Table 7 1. Eight-Step Approach for Indirect Effects Assessment Summarized from NCHRP Report 466

No.	Step
1	Scoping – Determine study approach, level of effort required, and location and extent of study area.
2	Identify Study Area Directions and Goals – Assemble information on trends and goals within study area.
3	Inventory Notable Features – Identify specific environmental issues within indirect effects study area.
4	Identify Impact-Causing Activities of Proposed Action and Alternatives – Break down activities into individual, impact-causing components for analysis.
5	Identify Potentially Significant Indirect Effects for Analysis – Catalog indirect effects by component activities; identify cause-effect linkages and interconnections that can delay and/or disperse effects; flag potentially significant indirect effects meriting further analysis.
6	Analyze Indirect Effects – Use quantitative and qualitative tools to determine magnitude, probability of occurrence, timing and duration, and degree to which the effect can be controlled or mitigated.
7	Evaluate Analysis Results – Evaluate assumptions and uncertainty associated with results and implications for indirect and cumulative effects assessments.
8	Assess Consequences and Develop Appropriate Mitigation and Enhancement Strategies – Assess consequences of indirect effects and develop strategies to address unacceptable outcomes.

Sources: Louis Berger Group, Inc. (2002), FHWA (2009).

Following this eight-step approach for the indirect effects assessments, WSDOT completed Steps 1 through 4 before and during the direct effects analyses. Chapter 4 of this SDEIS identifies the notable features referenced in Step 3, and Chapter 5 identifies the impact-causing activities and expected direct effects of the proposed 6-Lane Alternative; design options A, K, and L; and the No Build Alternative. The resource-specific reports supporting the SDEIS (Attachments 6 and 7) document these steps in greater detail. In Steps 5 through 8, WSDOT went beyond the direct effects assessments and focused on the intermediate cause-and-effect relationships and interconnections among resources that can lead to indirect effects. These steps are documented later in this chapter and in greater detail in the Indirect and Cumulative Effects Discipline Report (Attachment 7).

7.4 How did WSDOT assess cumulative effects?

To identify and evaluate likely cumulative effects and the extent to which the project would contribute to them, WSDOT first reviewed the general guidance in Section 412 of the *Environmental Procedures Manual* (WSDOT 2008d) and in FHWA Technical Advisory T 6640.8A (FHWA 1987). Next, they followed the eight-step procedure set forth in *Guidance on Preparing Cumulative Impact Analyses* (WSDOT, FHWA, and EPA 2008), shown in Table 7-2.

Table 7 2. Eight-Step Approach for Cumulative Effects Assessment Summarized from Guidance on Preparing Cumulative Impact Analyses

No.	Step
1	Identify the resources to consider in the analysis – List each resource for which the project could cause direct or indirect effects. If the project will not cause a direct or indirect effect on a resource, it cannot contribute to a cumulative effect on that resource. Make a statement to that effect, and stop.
2	Define the study area for each resource – Define the geographic resource study area and the temporal resource study area for each resource.
3	Describe the current status/viability and historical context for each resource – Characterize the current condition of the resource and trends affecting it, and briefly summarize the historical context and past actions that have had a lasting effect on the resource.
4	Identify direct and indirect impacts of the project that might contribute to a cumulative impact – Summarize the direct and indirect impacts already identified. The project's contribution to a cumulative effect would be the residual direct or indirect effect(s) remaining after mitigation.
5	Identify other current and reasonably foreseeable actions – Ask what other present and reasonably foreseeable actions (development projects) are affecting your resource today or could affect it in the future. A reasonably foreseeable action is a private or public project already funded, permitted, or under regulatory review, or included in an approved final planning document.
6	Identify and assess cumulative impacts – Review the information gathered, describe the cumulative impact(s), and draw conclusions that put into perspective the extent to which the project will add to, interact with, or reduce the cumulative impact.
7	Document the results – Describe the analyses, methods, or processes used; explain the assumptions; and summarize the results of each analysis, all the steps in adequate detail to disclose its strengths and weaknesses, your conclusions, and how and why you reached those conclusions.
8	Assess the need for mitigation – WSDOT does not mitigate cumulative effects because many entities contribute to them in ways that are beyond WSDOT's jurisdiction. But WSDOT does disclose the project's likely contribution to each identified cumulative effect and suggest practicable ways by which the cumulative effect could be mitigated.

Sources: WSDOT, FHWA, and EPA (2008).

WSDOT made two general assumptions in following the guidance. First, WSDOT considered construction-related effects to be short-term and temporary in relation to the long-term trends affecting the resources. Second, WSDOT considered operational effects of the project to be long-term and permanent through the project design year, 2030. On the basis of these two assumptions, WSDOT considered only direct or indirect effects of operating the completed facility as potential project contributions to cumulative effects. This was because in most cases, only these permanent effects would have the potential to influence long-term trends in the condition of the resources.

WSDOT did recognize, however, that in the case of a resource already under severe environmental stress, short-term construction effects added to the effects of other past, present, and reasonably foreseeable future actions could tip the balance and adversely affect the resource. No such case was found in the cumulative effects assessments conducted for this SDEIS.

The Indirect and Cumulative Effects Discipline Report provides information on the methods used to conduct the cumulative effects assessments on individual resources. These methods focused on long-term trends in the status or condition of each resource, and emphasized impact pathways and mechanisms through which the expected direct and indirect effects of the proposed action could accelerate, slow, or offset those trends.

7.5 How did WSDOT determine the study areas and time frames for the cumulative effects assessments?

WSDOT determined the cumulative effects study area for each resource was determined by: 1) the distribution of the resource itself and 2) the area within that distribution where the resource could be affected by the project in combination with other past, present, and reasonably foreseeable future actions. For most resources, the cumulative effects study area is the central Puget Sound region as defined by the Puget Sound Regional Council (PSRC) in its planning document Vision 2040 (PSRC 2008). Exhibit 7-1 shows the central Puget Sound region, which includes portions of King, Kitsap, Pierce, and Snohomish counties. Some resources required cumulative effects study areas that were larger or smaller than the central Puget Sound region, and these are shown in Exhibit 7-2.

The time frame for the cumulative effects assessment for each resource starts at a representative year or decade when past actions began to change the status of the resource from its original condition, setting a long-term trend still evident in the present and likely to continue into the reasonably foreseeable future.

Exhibit 7-1. Indirect and Cumulative Effects Study Area

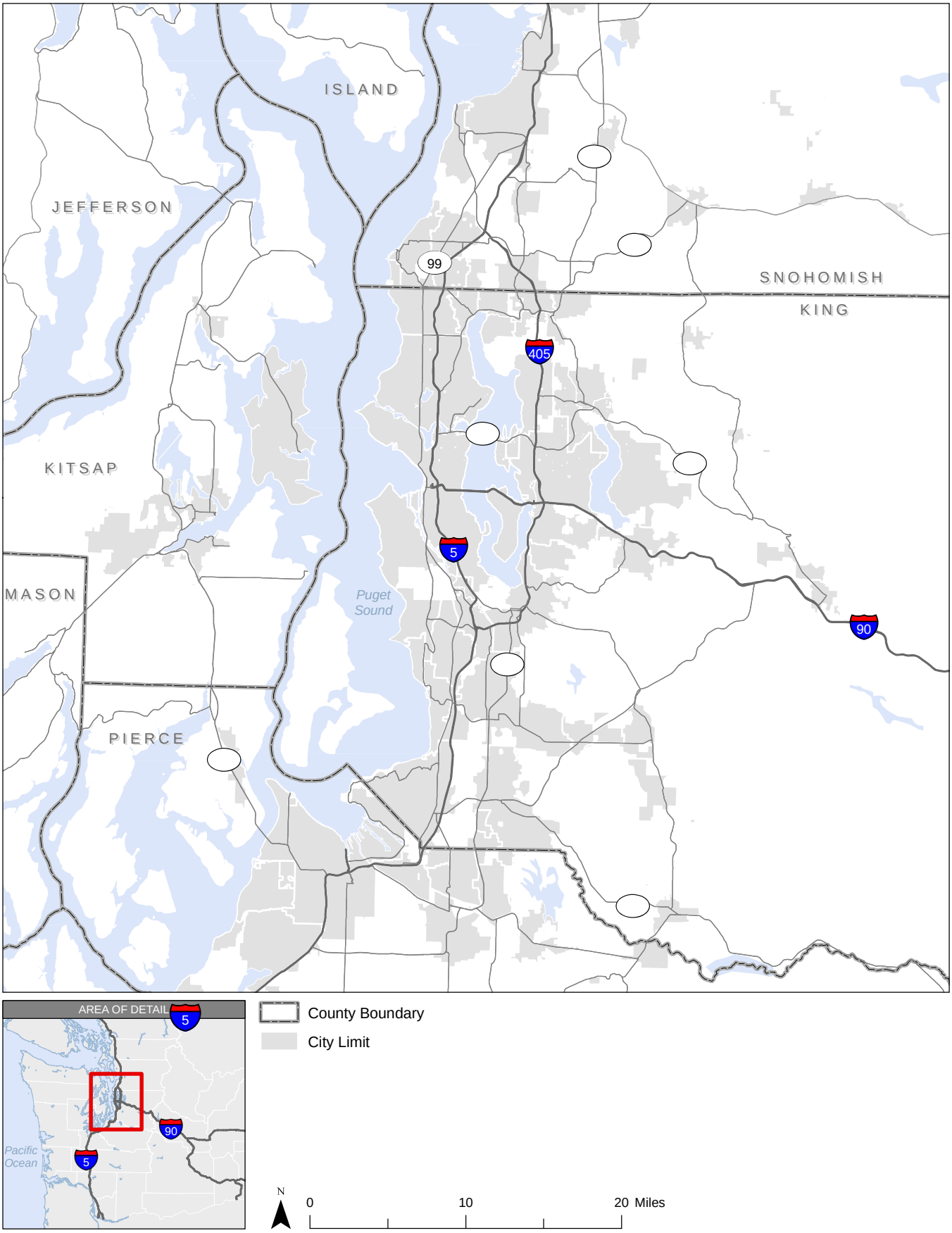
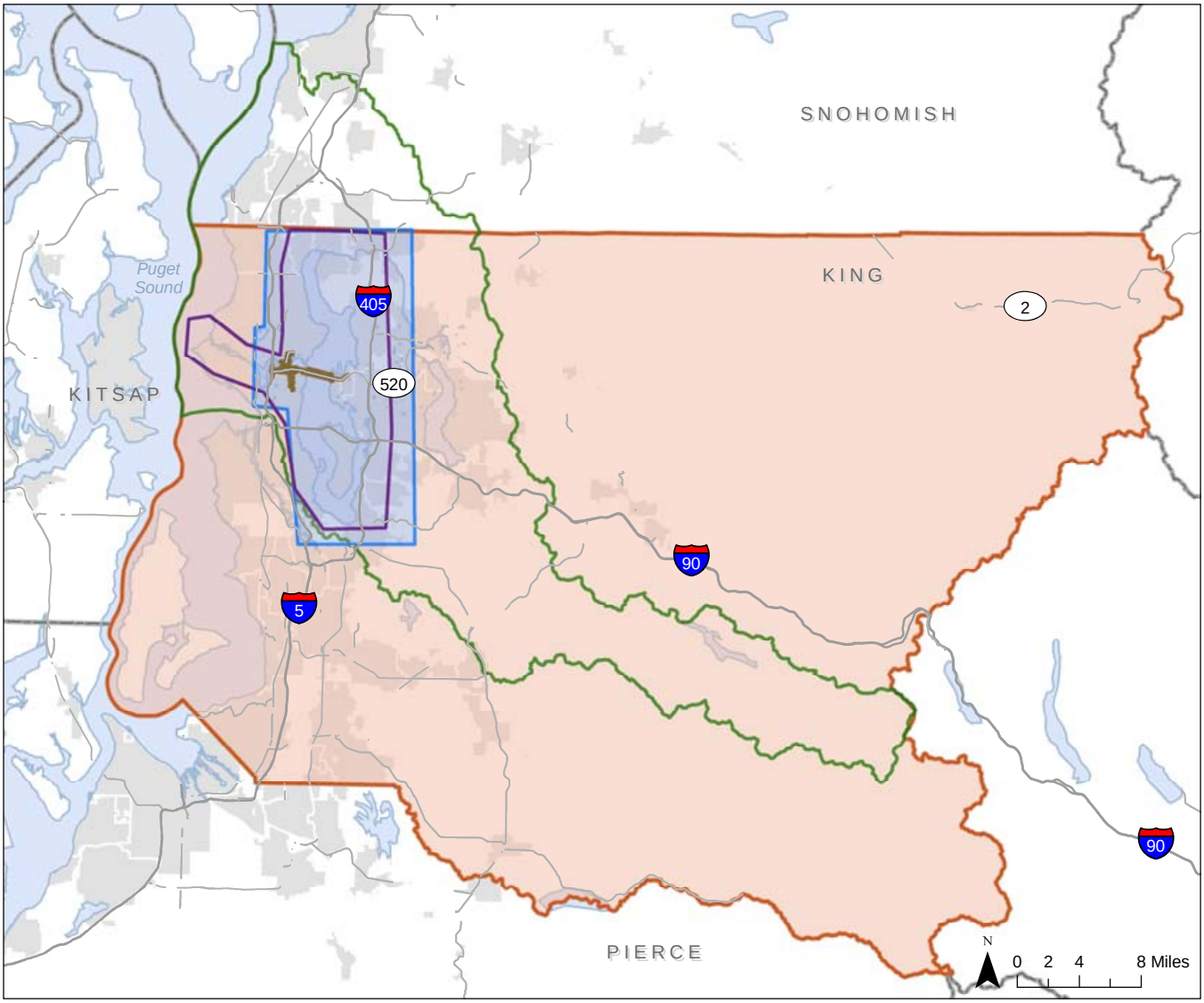


Exhibit 7-2. Resource Specific Study Areas for Indirect and Cumulative Effects



Cultural Resources
Ecosystems
Water Resources
Environmental Justice, Hazardous Materials, Land Use, and Visual Quality
Navigable Waterways
Air Quality, Economics, Geology, Soils and Transportation
County Boundary
City Limit

N
0 15 30 60 Miles

For most resources, the cumulative effects time frame starts in the mid-nineteenth century, when the central Puget Sound region began to be altered by non-Native American settlers. The time frame for all resources ends in 2030, the project design year.

7.6 How did WSDOT determine the baseline condition of each resource?

WSDOT characterized the baseline (present) condition of each resource by describing its current status within the cumulative effects study area and by providing historical context for understanding how the resource got to its current state (WSDOT, FHWA, and EPA 2008; see Table 7-2, Step 3). WSDOT used information from field surveys, interviews, and literature searches to assess the current condition of the resource, relying especially on baseline information presented in PSRC's Transportation 2040 Draft Environmental Impact Statement (Transportation 2040 DEIS) issued in May 2009 (PSRC 2009a).

Chapter 4 of this SDEIS presents information on the baseline condition of each resource addressed in the indirect and cumulative effects assessments. The transportation section in Chapter 5 of this SDEIS describes how traffic would grow in the region and on SR 520, I-90, SR 522, and other major roads with and without the proposed 7-Lane Alternative. Through the use of a travel demand model, traffic volumes were predicted for the year 2030 with and without the project. Future traffic was forecast for morning and evening commutes (peak hour travel), which enabled an assessment of how travel times would be affected and where congestion would occur. This section also examined how the project would affect transit facilities and service, non-motorized facilities, and parking.

WSDOT did not address the past in detail, but prepared a brief summary to place each resource in its historical context and identify long-term trends affecting the condition of the resource.

7.7 How did WSDOT identify other present and reasonably foreseeable future actions?

To identify other present and reasonably foreseeable future actions (see Table 7-2, Step 5), WSDOT reviewed comprehensive land use planning documents, long-range transportation plans, projections presented in the Transportation 2040 Draft EIS (PSRC 2009a), and agency Web sites to obtain publicly available information. They also interviewed agency and tribal officials, representatives of private companies and organizations, and members of the public during the scoping process conducted for this environmental process. The Agency Coordination and Public Involvement

DEFINITION

Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions were defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation.

Discipline Report (Attachment 7) provides information about the scoping process and meetings.

Reasonably foreseeable future actions were defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation. Accordingly, WSDOT applied the following criteria (WSDOT, FHWA, and EPA 2008):

- Is the proposed project included in a financially constrained plan (e.g., a capital improvement program)
- Is it permitted or in the permit process?
- How reasonable is it to assume that the proposed project will be constructed?
- Is the action identified as high priority?

Applying these criteria, WSDOT compiled lists of present and reasonably foreseeable future actions to support the discipline-specific cumulative effects assessments.

Exhibits 7-3, 7-4a through 7-4d, and 7-5a and b identify the approximate locations of present and reasonably foreseeable future land development or redevelopment projects and transportation improvement projects that could interact with the effects of past actions and with those of the proposed project to produce cumulative effects. The reasonably foreseeable future actions include WSDOT's proposed Pontoon Construction Project and the SR 520, Medina to SR 202: Eastside Transit and HOV Project, each of which has independent utility and is currently the subject of environmental review under NEPA. These and other present and reasonably foreseeable transportation improvement and land development projects are included in the forecasts presented in the Transportation 2040 Draft EIS (PSRC 2009a), which served as a basis for the cumulative effects assessments summarized in this SDEIS.

7.8 What indirect and cumulative effects did WSDOT identify?

The rest of this chapter briefly discusses indirect and cumulative effects that could be associated with the proposed 6-Lane Alternative. The Indirect and Cumulative Effects Discipline Report provides additional information.

Exhibit 7-3. Present and Reasonably Foreseeable Future Actions

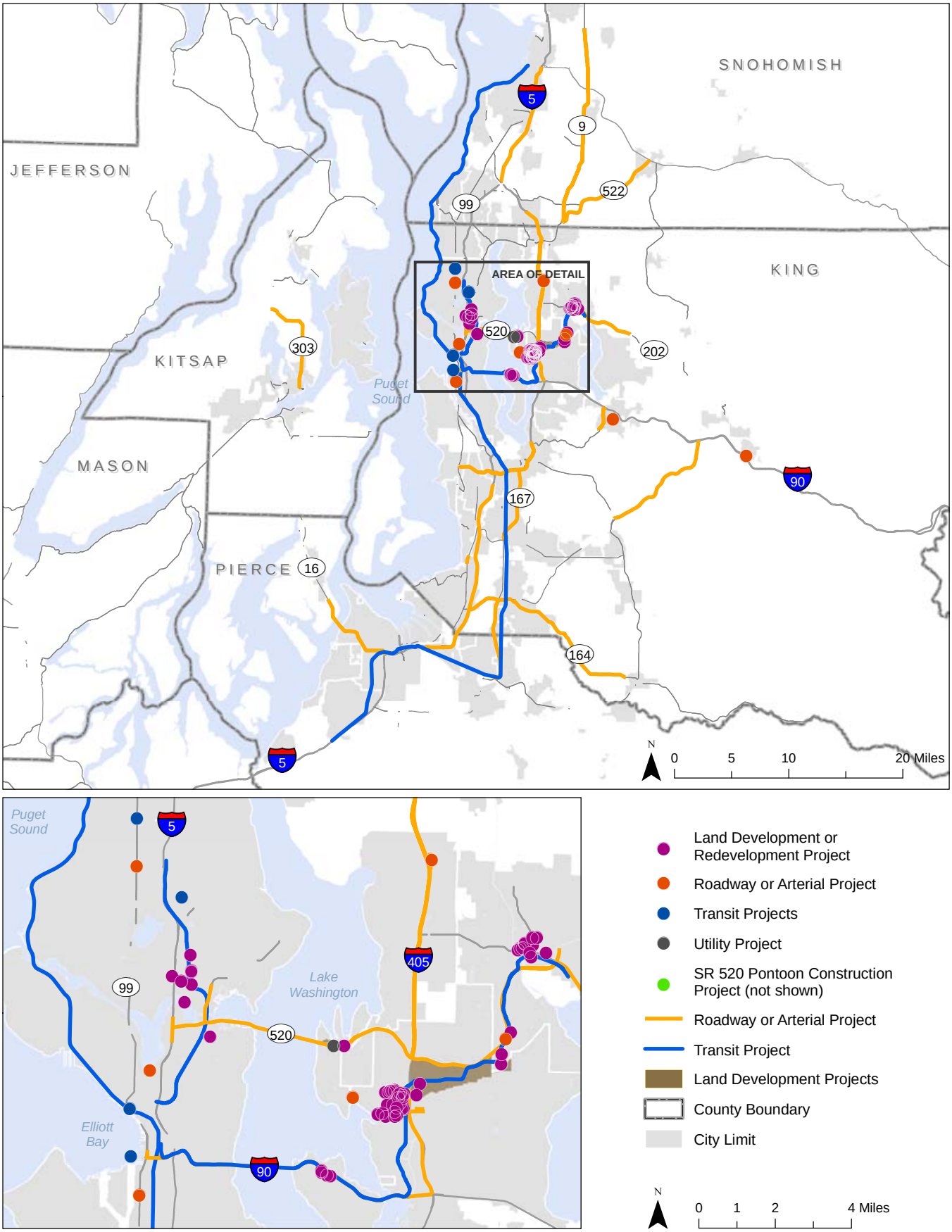
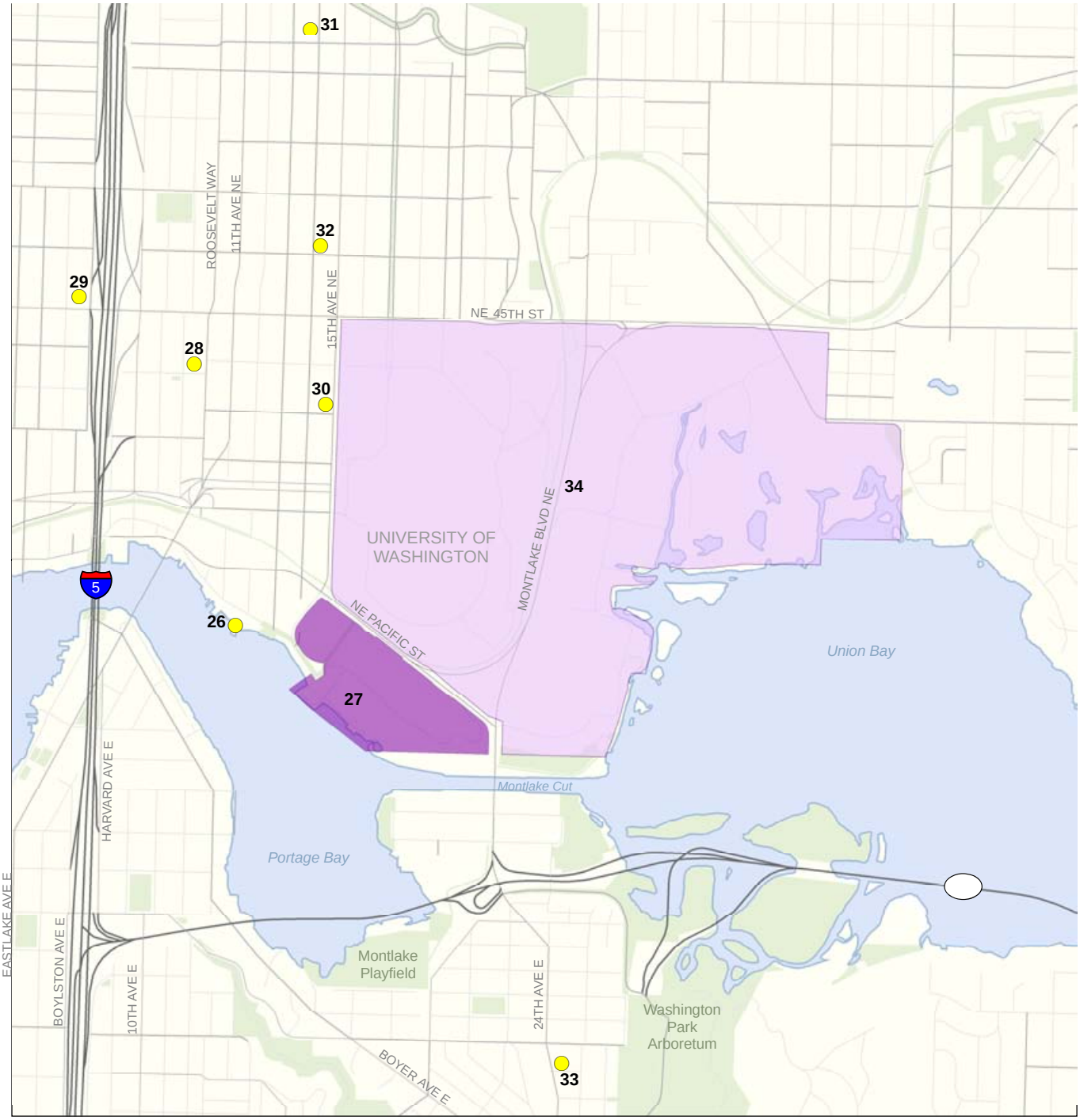
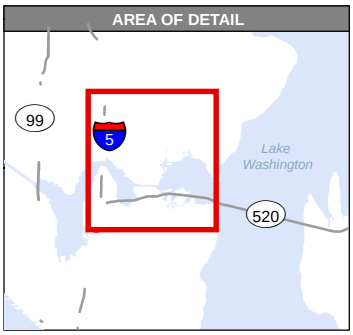


Exhibit 7-4a. Seattle Land Use





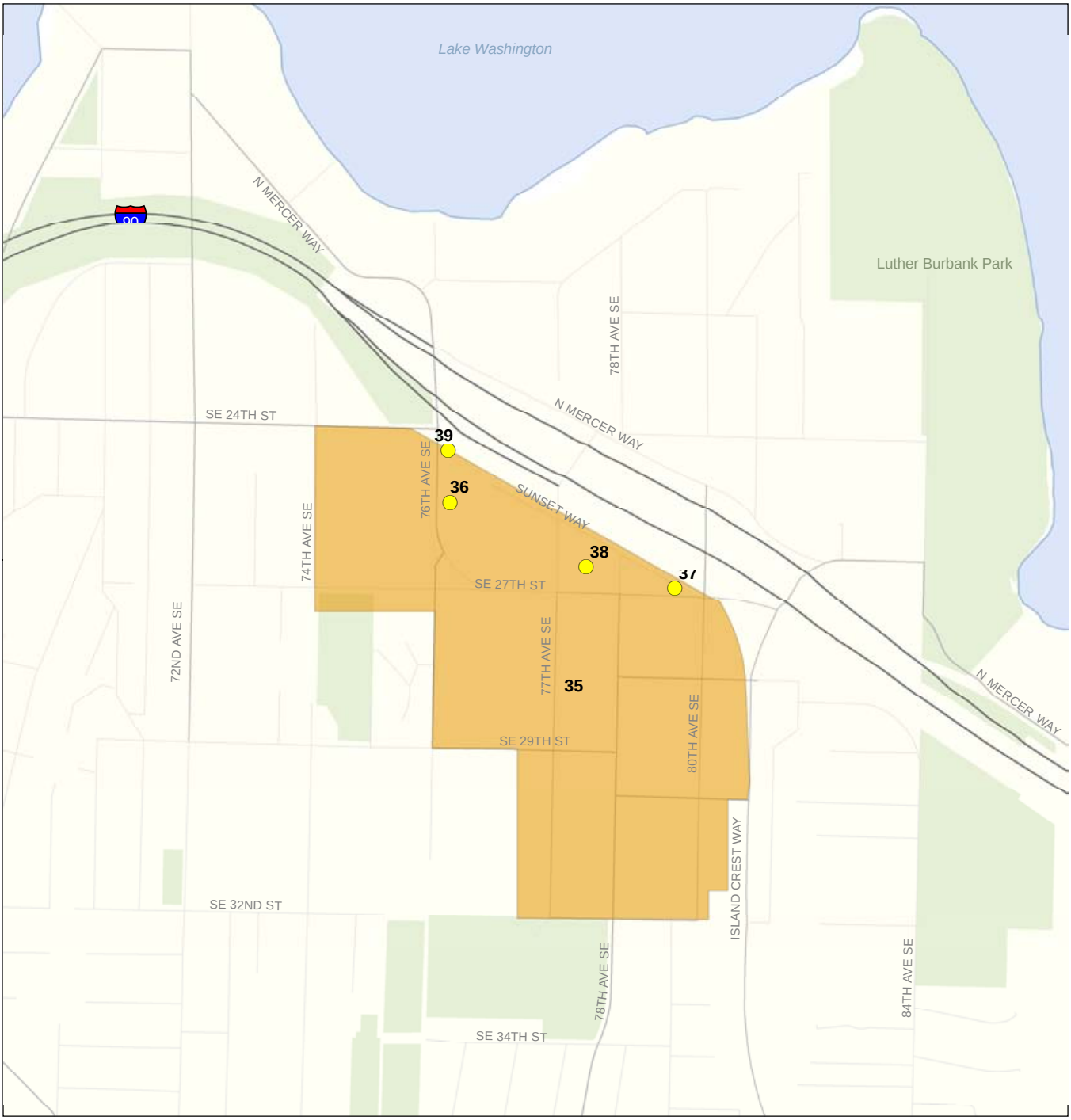
ID	Project
26	Car Top Boat Launch and Portage Bay Vista
27	University of Washington Medical Center Master Plan
28	Mixed Use Development
29	Mixed Use Development
30	Mixed Use Development
31	Mixed Use Development
32	Mixed Use Development
33	Mixed Use Development
34	University of Washington Campus Master Plan

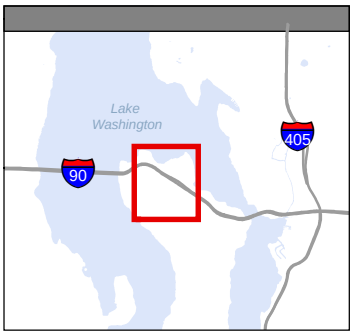
- Land Development or Redevelopment Project
- University of Washington Campus Master Plan
- University of Washington Medical Center Master Plan
- Park

N

0 500 1,000 2,000 Feet

Exhibit 7-4b. Mercer Island Land Use





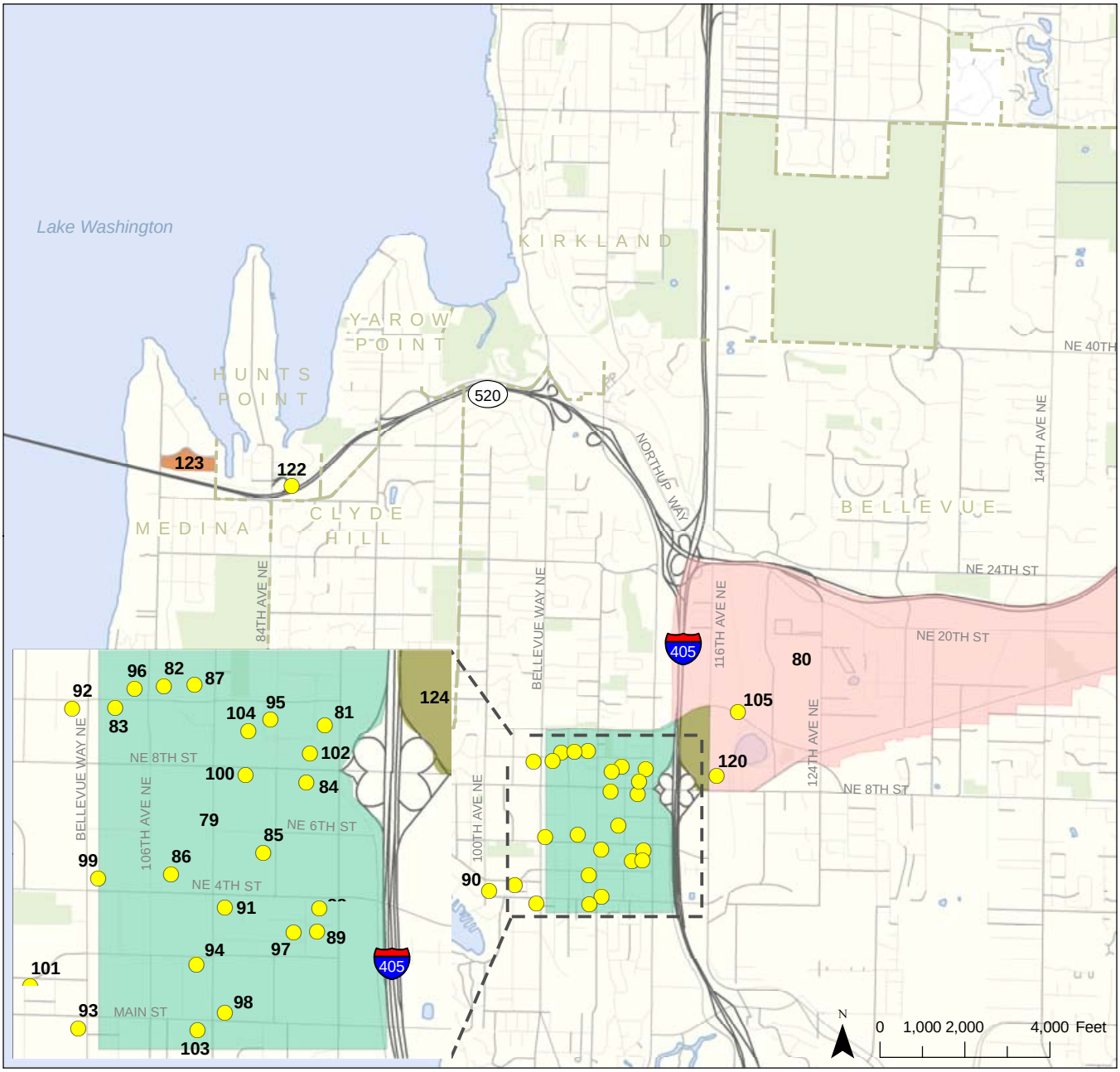
ID	Project
35	Town Center District Plan
36	Aljoya at Mercer Island (ERA Living Senior Housing)
37	7800 Plaza
38	7700 Central
39	BRE

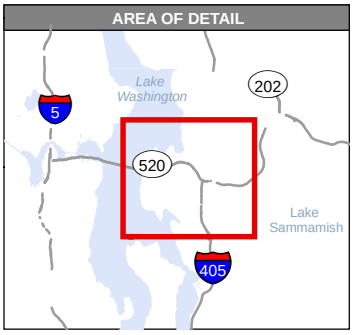
- Land Development or Redevelopment Project
- Mercer Island Town Center District Plan
- Park

N

0 250 500 1,000 Feet

Exhibit 7-4c. Bellevue Land Use

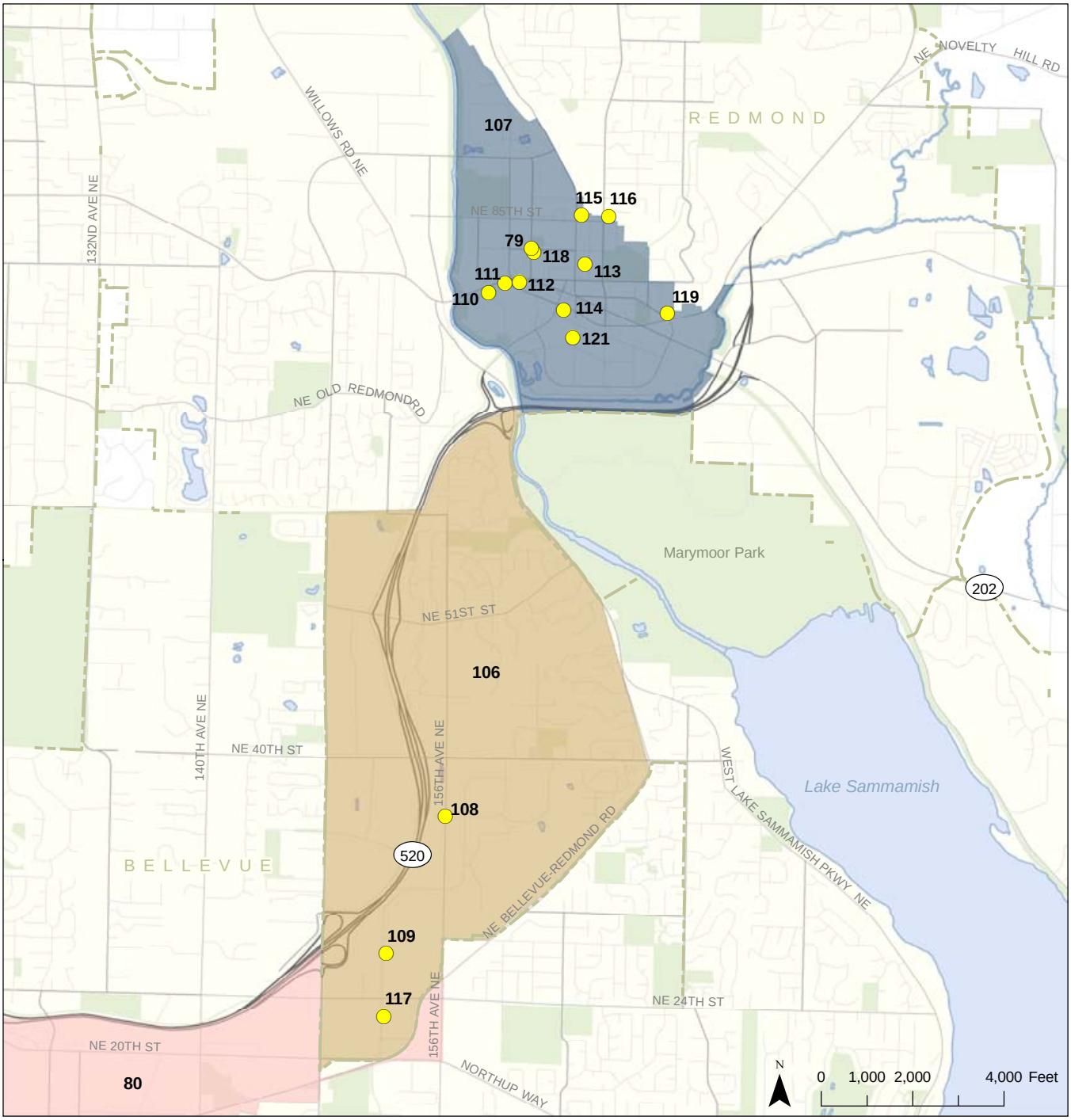


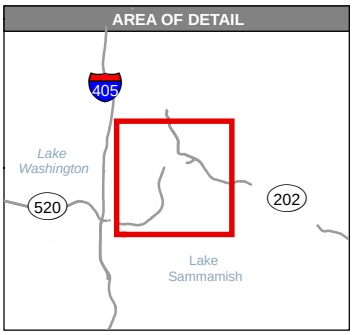


ID	Project
80	Bel-Red Corridor
81	Ashwood II
82	Belcarra Apartments
83	Euro Tower I
84	Hanover Bellevue Cadillac
85	Marriott Hotel
86	Legacy Apartments
87	Bellevue Place Hyatt Hotel
88	Bravern
89	City Center East
90	Bellevue Towers
91	The Ashton
92	Avalon at NE 10th Street
93	Bellevue at Main Street
94	Bellevue Plaza
95	Metro 112
96	Meydenbauer Inn
97	One Main
98	The Summit Building C
99	Lincoln Square II
100	8th Street Office Highrise
101	The Essex
102	Vida Condominiums
103	Vantana on Main
104	Pacific Regent Phase II
105	NE 112th Substation
120	Bellevue/Redmond Overlake Transportation (BROTS) (Bellevue/Redmond)
122	Expressway Nature Trail
123	Fairweather Nature Preserve Long Range Park Improvements
124	Overlake Hospital Master Plan

- Land Development or Revelopment Project
- Bel-Red Corridor Project
- Downtown Implemention and Subarea Plan
- Fairweather Nature Preserve Long Range Park Improvements
- Overlake Hospital Master Plan
- Park

Exhibit 7-4d. Redmond Land Use





ID	Project	ID	Project
79	Downtown Implementation and Subarea Plan	115	Tudor Manor
80	Bel-Red Corridor Plan	116	Perrigo Park
106	Overlake Neighborhood Plan Update and Implementation (Redmond)	117	White Swan
107	Redmond Downtown Neighborhood Plan	118	Redmond Court
108	Microsoft Expansion (Microsoft/Redmond)	119	Parkside Apartments
109	Group Health Property	121	Redmond Transit Oriented Development
110	Redmond River Park		
111	Cleveland Street West		
112	Cleveland Street East		
113	Portula'ca		
114	Center Pointe		

- Land Development or Redevelopment Project
- Bel-Red Corridor Project
- Overlake Neighborhood Plan
- Redmond Downtown Neighborhood Plan
- Park

Exhibit 7-5a. Reasonably Foreseeable Future Actions - Transportation

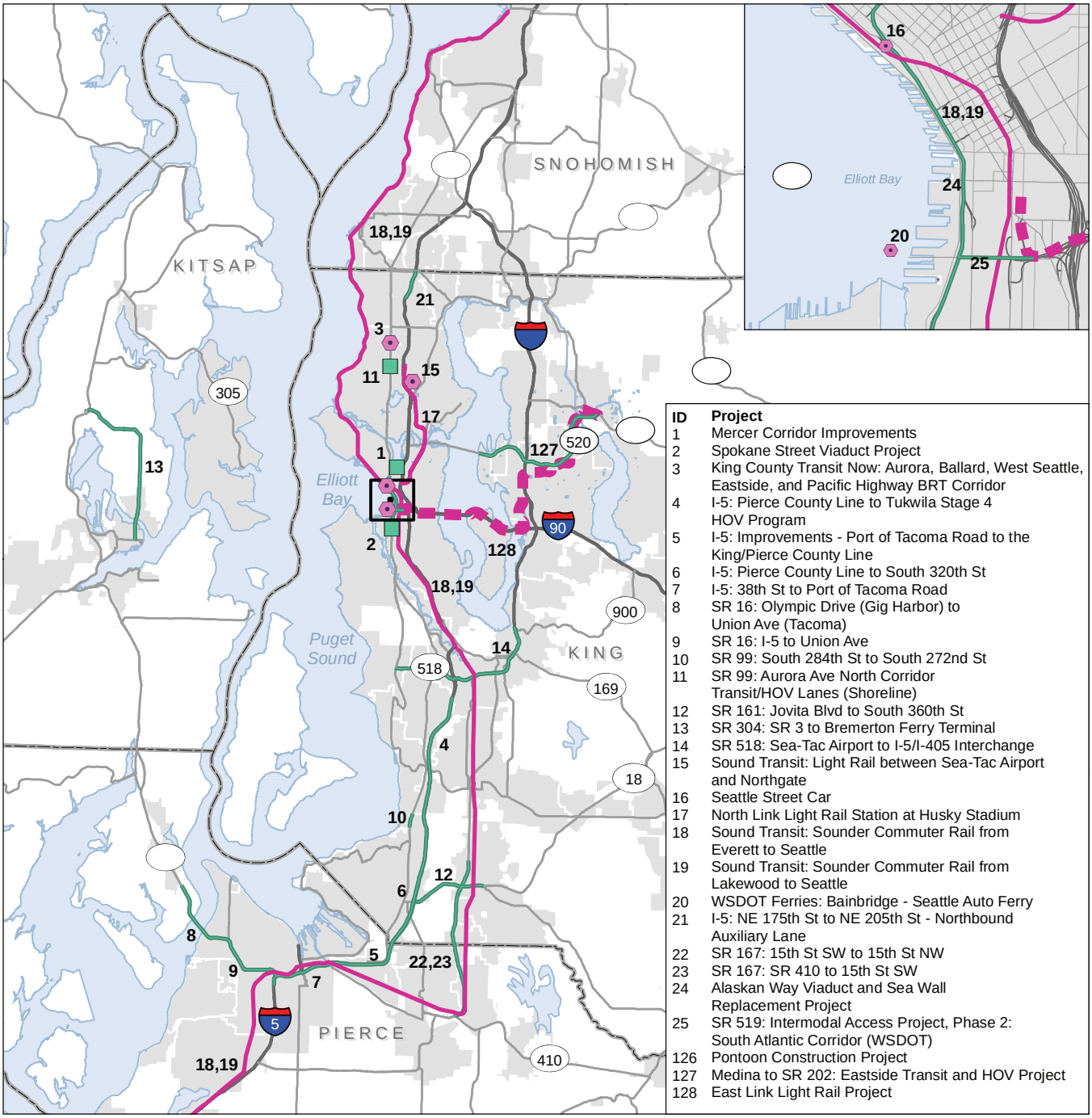
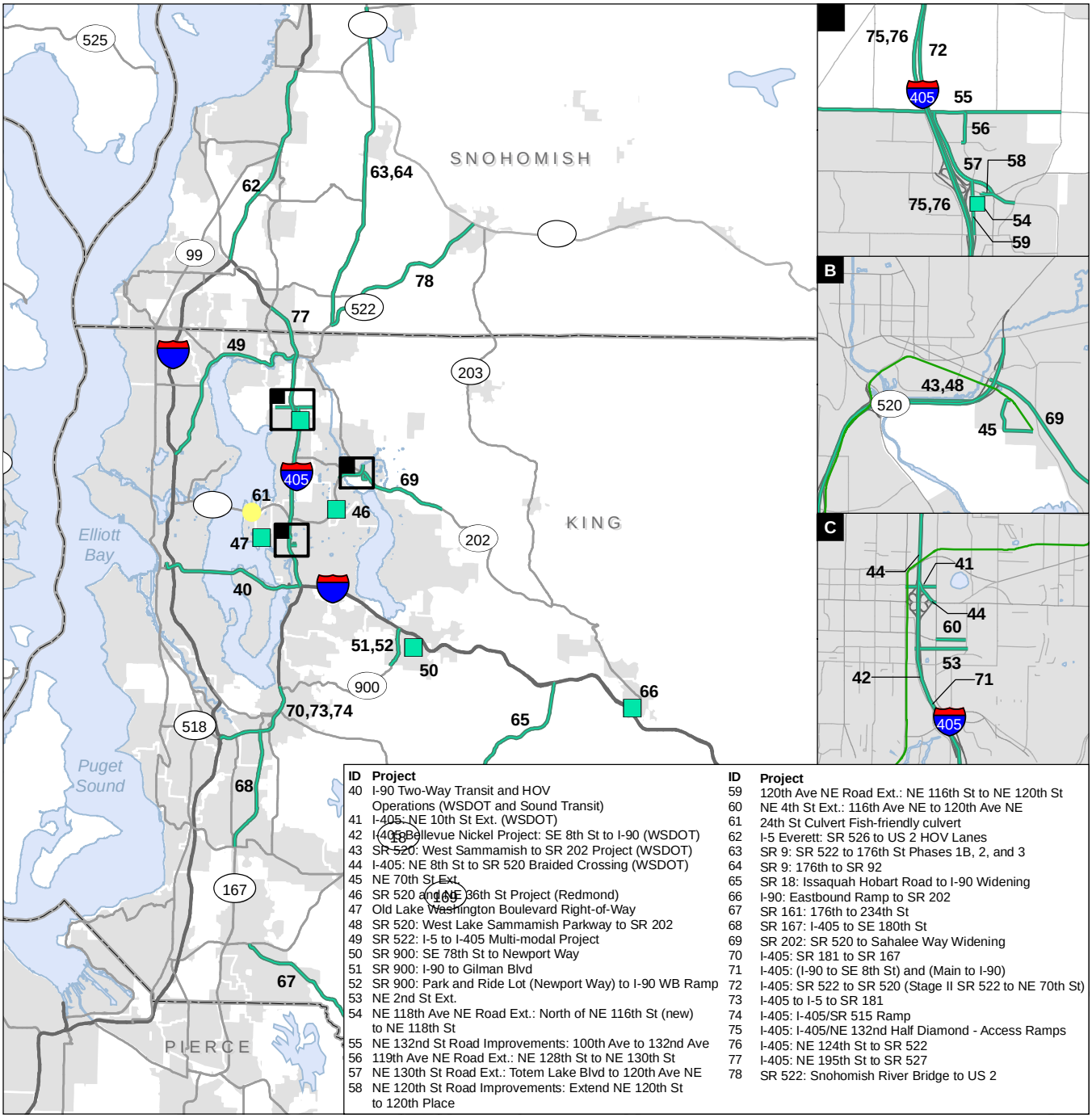
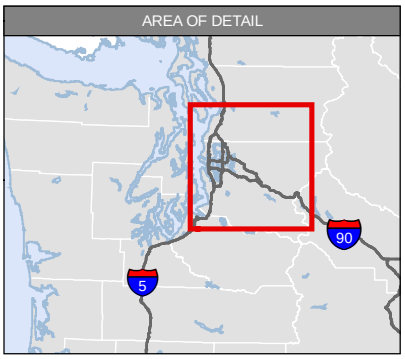


Exhibit 7-5b. Reasonably Foreseeable Future Actions - Transportation



ID	Project
40	I-90 Two-Way Transit and HOV Operations (WSDOT and Sound Transit)
41	I-405: NE 10th St Ext. (WSDOT)
42	I-405 Bellevue Nickel Project: SE 8th St to I-90 (WSDOT)
43	SR 520: West Sammamish to SR 202 Project (WSDOT)
44	I-405: NE 8th St to SR 520 Braided Crossing (WSDOT)
45	NE 70th St Ext.
46	SR 520 and NE 36th St Project (Redmond)
47	Old Lake Washington Boulevard Right-of-Way
48	SR 520: West Lake Sammamish Parkway to SR 202
49	SR 522: I-5 to I-405 Multi-modal Project
50	SR 900: SE 78th St to Newport Way
51	SR 900: I-90 to Gilman Blvd
52	SR 900: Park and Ride Lot (Newport Way) to I-90 WB Ramp
53	NE 2nd St Ext.
54	NE 118th Ave NE Road Ext.: North of NE 116th St (new) to NE 118th St
55	NE 132nd St Road Improvements: 100th Ave to 132nd Ave
56	119th Ave NE Road Ext.: NE 128th St to NE 130th St
57	NE 130th St Road Ext.: Totem Lake Blvd to 120th Ave NE
58	NE 120th St Road Improvements: Extend NE 120th St to 120th Place
59	120th Ave NE Road Ext.: NE 116th St to NE 120th St
60	NE 4th St Ext.: 116th Ave NE to 120th Ave NE
61	24th St Culvert Fish-friendly culvert
62	I-5 Everett: SR 526 to US 2 HOV Lanes
63	SR 9: SR 522 to 176th St Phases 1B, 2, and 3
64	SR 9: 176th to SR 92
65	SR 18: Issaquah Hobart Road to I-90 Widening
66	I-90: Eastbound Ramp to SR 202
67	SR 161: 176th to 234th St
68	SR 167: I-405 to SE 180th St
69	SR 202: SR 520 to Sahalee Way Widening
70	I-405: SR 181 to SR 167
71	I-405: (I-90 to SE 8th St) and (Main to I-90)
72	I-405: SR 522 to SR 520 (Stage II SR 522 to NE 70th St)
73	I-405 to I-5 to SR 181
74	I-405: I-405/SR 515 Ramp
75	I-405: I-405/NE 132nd Half Diamond - Access Ramps
76	I-405: NE 124th St to SR 522
77	I-405: NE 195th St to SR 527
78	SR 522: Snohomish River Bridge to US 2



Utility Project
Roadway or Arterial Project
Roadway or Arterial Project
County Boundary
City Limit

N

0 2.5 5 10 Miles

Transportation

What indirect effects would the project likely have on transportation?

A travel demand model was used to estimate the project's likely indirect effects on transportation. Indirect effects include changes in regional travel patterns in Seattle and Eastside areas outside the project limits, for example on I-405 and I-5. For both I-405 and I-5, it was predicted that vehicle and person trips for the 6-Lane and No Build Alternatives would be similar (that is, the differences were slight). This is particularly true for north-south trips.

However, the analysis indicates that there would be a slight increase in east-west person trips from these areas, which is likely due to increased HOV capacity (see Chapter 2 of the Transportation Discipline Report [Attachment 7]). Detailed results for transportation effects are reported in the Transportation section of Chapter 5 and in the Transportation Discipline Report.

What would the cumulative effect on transportation likely be?

There would be cumulative effects on transportation during construction of the SR 520 improvements. This is due to the length of time required to construct the proposed improvements and the ongoing development of other projects in the area that are likely to occur at the same time. For example, the University of Washington is making improvements to the campus and medical center in the vicinity of Portage Bay; Sound Transit is constructing University Link; there are mixed-use developments occurring on the west end of the project; and there are a number of projects underway or planned in the Eastside cities of Bellevue, Mercer Island, Redmond, and Kirkland (see Exhibits 7-4a through 7-4d). Projects occurring at the same time as the SR 520 project will result in the following construction-related cumulative impacts on transportation (in addition to those described previously in the direct impacts section):

- Truck traffic traveling through the SR 520 construction zone from construction vehicles and delivery of materials
- Additional lane closures and road detours, particularly on the local street system, which would cause slowdowns and some drivers to alter their routes (this may result in more cut-through traffic in neighborhoods)
- Short-term and permanent modifications to access
- Temporary changes to transit and non-motorized facilities

During project operation, transportation options and traffic conditions would improve as a result of the SR 520 project in combination with other reasonably foreseeable future transportation improvements within the SR 520 study area through the year 2030. A considerable increase in carpool and transit demand along SR 520 would occur with all of the 6-Lane Alternative options because the SR 520 program would complete the HOV lane system between Redmond and Seattle and reduce travel times and congestion choke points. This increase is also due to the assumption that transit and 3-person or more carpools would not be required to pay a toll on SR 520.

With or without the project, there would be additional demand for transit options, including buses and light rail. It is anticipated that the overall transit demand would increase 51 percent under the No Build Alternative and 14 percent under the 6-Lane Alternative by 2030 (see Chapter 2 of the Transportation Discipline Report). Thus, there would be a need for additional buses along the SR 520 corridor and the other major routes across or around Lake Washington (that is, SR 522 and I-90) during both peak and off-peak periods. For the period between 2006 and 2016, the King County Transit Now program will increase the frequency of bus service for existing routes, as well as add service on new routes (there has already been an increase of 52,000 bus hours under this program). After 2016, it is assumed that there would be an increase of 1 percent per year in bus service between the years 2016 and 2030.

Light rail demand on I-90 (East Link) would also increase, as would related transit connections (such as Sounder, North Link, ST Express, and Metro). Demand for light rail will enable expansion of the Sound Transit light rail to Lynnwood. Similarly, tolling and focus on increased transit opportunities would reduce demand for use of the SR 520 corridor by single-occupancy vehicles. There would be increased opportunities for non-motorized travel, which would also reduce some vehicle traffic.

How could cumulative effects on transportation be mitigated?

Cumulative construction-related effects could be mitigated by developing a comprehensive plan to control traffic during construction and a public outreach/communication plan to inform people of such things as lane closures, detours, and delays. This should include coordination of a traffic control plan with WSDOT, the City of Seattle, Sound Transit, University of Washington, and emergency service providers, as well as allowing consideration for special events. Some elements of the plan would include:

- Measures to minimize disruption of access to businesses and properties
- Details on required street and lane closures including timing
- Measures to minimize impact on transit operations

- Traffic enforcement measures, including use of police officers
- Measures to minimize the impact of traffic and parking from construction workers

See Chapter 12 of the Transportation Discipline Report for additional mitigation for construction.

Generally, transportation improvements provide a beneficial effect by increasing roadway capacity and the efficiency of intersection operations, reducing congestion, enhancing safety, and improving access. The SR 520, I-5 to Medina project would provide these benefits, as well as improving transit and non-motorized facilities and reducing transit travel times.

There are a number of planned or reasonably foreseeable transportation improvements that would mitigate potential increases in traffic on SR 522 and I-90 resulting from the proposed tolling of SR 520. For I-90, these include the Sound Transit East Link light rail project and the WSDOT/Sound Transit I-90 Two-Way Transit and HOV Operations project. The WSDOT I-5 to I-405 Multi-modal project is planned for SR 522. In addition, Sound Transit 2 and the Transit Now programs will continue to expand and increase the regional express and local bus service.

Land Use

What indirect effects would the project likely have on land use?

Transportation projects can have indirect effects on land use if the projects bring about later changes in the rate and pattern of development. In Washington, the Growth Management Act (36.70A RCW) directs local jurisdictions to plan and regulate development patterns and population growth. The Growth Management Act requires that state and local governments work cooperatively to identify and protect critical areas and natural resource lands, designate urban growth areas, prepare comprehensive plans, and implement them through capital investments and development regulations.

Overall, the amount of land converted from civic/quasi-public, park, and commercial and single-family residential use represents a small percentage of these types of land uses within the City of Seattle. No substantial change to the overall urbanized land use pattern in Seattle and no indirect effects on land use patterns would occur. Planned growth as regulated under the Growth Management Act would occur with or without the project.

What would the cumulative effect on land use likely be?

Land use planning is conducted at the regional level (Vision 2040*),* and the decisions are implemented in local comprehensive plans that must be consistent with Vision 2040 and Washington's Growth Management Act.

The SR 520 project's contribution to the cumulative effect on land use would not be adverse or substantial in combination with other past, present, and reasonably foreseeable future actions. This finding was supported by the land use analysis in the Transportation 2040 Draft EIS, which incorporated reasonably foreseeable changes in central Puget Sound's future land use, population, employment, and travel patterns, including the SR 520 project.

The SR 520 project, in conjunction with other reasonably foreseeable future actions, would convert existing land uses to transportation right-of-way. Although these conversions would reduce the area of land available to a small extent, they would cumulatively convert only a small portion of the total land in the central Puget Sound region over the next 30 years. The SR 520 project's contribution of between 11.1 and 15.7 converted acres would not be substantial in a regional context.

How could the cumulative effect on land use be mitigated?

The Transportation 2040 Draft EIS suggests general strategies for urban land use that would mitigate adverse effects of transportation projects on land use at the regional, or cumulative, level (PSRC 2009a). Regional and local planning organizations are the focal points for gathering public input and suggesting priorities for the future land uses.

Economic Activity

What indirect effects would the project likely have on economic activity?

Operation of the completed 6-Lane Alternative would not indirectly affect the regional economy, except through beneficial effects of improved transportation efficiency. Because the proposed project would replace part of an existing transportation corridor through an urban area that has already been developed, it would not change land use or development patterns. For more information on the long-term effects of the project on transportation efficiency, see the Transportation Discipline Report.

What would the cumulative effect on economic activity likely be?

WSDOT concluded that long-term operation of the proposed project would not directly or indirectly affect the economy. Therefore, the proposed project would not contribute to lasting trends from other past, present, or reasonably foreseeable actions that would have a cumulative effect on economic activity.

Social Elements

What indirect effects would the project likely have on social elements, including public services and utilities?

Construction and operation of the 6-Lane Alternative would not change demographics or existing land use patterns, or increase demand for infrastructure or services within the project area, as the project would not induce growth (see the Land Use, Economics, and Relocations Discipline Report in Attachment 7). Therefore, no indirect effects on social elements, including public services and utilities, would result from the project.

What would the cumulative effect on social elements likely be?

The proposed project would benefit community cohesion and would not result in any long-term adverse effect on public service providers. All negative effects would be temporary and involve the typical disruptions experienced during roadway construction activities. Therefore, the project would not contribute to a cumulative effect on social elements.

Environmental Justice

What indirect effects would the project likely have on low income, minority, or limited-English-proficient populations?

The environmental justice analysis concluded that the SR 520, I-5 to Medina: Bridge Replacement and HOV Project would result in a disproportionately high and adverse effect on low-income populations. The disproportionate effect would be because of tolling only and is discussed in Section 5.3 and in the Environmental Justice Discipline Report (Attachment 7). The project would not adversely affect minority populations. Other effects of the project on low-income and minority populations would be positive. None of the expected effects, whether beneficial or adverse, would be indirect.

What would the cumulative effects on low-income and minority populations likely be?

Low-Income Populations

The Washington Legislature is exploring opportunities to introduce tolling as a sustainable source of transportation funding, and the proposed project is a part of this funding strategy. Tolling on SR 520 could contribute to the existing heavy traffic loads on alternative routes such as I-405, SR 522, and I-90—all of which pass through or near neighborhoods that include low-income populations. The cumulative effects of heavy traffic include noise, air emissions, and lowered transportation efficiency due to idling or slow-

moving vehicles. These conditions could worsen as drivers select alternative routes to avoid tolling on SR 520. Tolling on SR 520 could also increase transportation costs for low-income households and social service agencies that serve low-income populations.

At the same time, tolling on SR 520 could benefit all drivers and transit riders by providing faster, more reliable trips and a sustainable source of funding for transportation improvements. The contribution of the SR 520, I-5 to Medina: Bridge Replacement and HOV Project, in conjunction with other planned transit and light rail projects and the SR 520 Lake Washington Congestion Management Project, would help promote affordable mobility for low-income populations by increasing the efficiency of the regional transportation system above present levels. The project would contribute to this beneficial cumulative effect by providing HOV lanes and transit facilities along the corridor to allow expansion of transit service.

Native American Populations

The 6-Lane Alternative is expected to provide slight benefits to water quality and fisheries resources used by Native American populations. However, the effects on the long-term fisheries trends and stressors that contribute to cumulative effects would not be measurable.

The amount of affected fish habitat within the study area represents an extremely small fraction of the habitat available within the area watersheds overall, and only a small portion of that fraction is regularly used by salmon and related species (primarily the nearshore and shallow-water habitat areas). In summary, the project's contribution to the overall condition of fish and aquatic resources within the study area would not measurably influence the cumulative effect on these resources. See the Ecosystems section of this chapter for a discussion of potential cumulative effects on fish and fish habitat.

The project is not likely to add to the cumulative effect on Native American traditional cultural properties, or the presumed Foster Island TCP.

How could the cumulative effect on low-income and minority populations be mitigated?

Low-Income Populations

Cumulative effects on low-income populations from tolling, described previously as relating to increased traffic on alternative routes selected by drivers to avoid tolling on SR 520, could be minimized by regional planning efforts to improve transit service and implement light rail across the region. In addition, mitigation measures being considered for the SR 520 Lake Washington Congestion Management Project could help reduce the burden that electronic tolling would place on low-income drivers by offering

transit-accessible service centers, establishing transponder retail outlets in convenient locations, and allowing several different types of payment methods.

To mitigate cumulative effects on the neighborhoods surrounding non-tolled alternative routes such as I-405, SR 522, and I-90—including the low-income populations living within those neighborhoods—local, regional, and state jurisdictions could coordinate to identify mobility improvements in the non-tolled corridors. Ultimately, providing affordable housing in urban centers so that people could live closer to work would mitigate the adverse effects of expenses, potentially including tolling, that are associated with the daily commute.

Native American Populations

The Ecosystems cumulative effects discussion later in this chapter notes that a variety of measures could mitigate cumulative effects on fish and aquatic resources. Some of these efforts could also reduce the cumulative effect on Native American populations.

Recreation

What indirect effects would the project likely have on recreation?

Indirect effects on recreational resources can occur when there are changes in access, surrounding land use, noise levels, or visual intrusion that affect the value and integrity of the resource for park users. Most indirect effects on park and recreational resources would be positive by encouraging greater use of recreational resources, improving connectivity and linkages between parks, and improving noise levels and visual quality in certain locations.

Any replacement park property developed as part of mitigation for direct effects would create additional recreational areas for park users. The bicycle/pedestrian path and lids would encourage pedestrian and bicycle use over the long term. In the Arboretum, removal of the Lake Washington Boulevard ramps and R.H. Thomson Expressway ramps would remove visual clutter and improve views to and from the park over the long term. Inclusion of noise walls (as approved by affected neighborhoods) would also produce long-term benefits for park users.

All options would displace MOHAI, a resource that serves the region's population and tourists that visit Seattle. However, the museum has plans to relocate its facilities from its current location in McCurdy Park and East Montlake Park. Because MOHAI is somewhat isolated and access is limited (primarily via 24th Avenue East), relocation to an area with more accessibility and visibility could directly and indirectly benefit this resource over time. The Arboretum Master Plan (City of Seattle, University of Washington, and The Arboretum Foundation 2001) envisioned that

MOHAI would vacate its current building in the near future, and that the structure would be used by the Seattle Parks Department and Arboretum and University of Washington staff for purposes related to the Arboretum.

The Waterfront Activity Center is located at the east end of the Montlake Cut on the north shore across from the Arboretum. Many visitors and residents rent canoes here to explore the shoreline areas in the Arboretum north and south of the roadway. Options A and L have a higher profile than Option K, meaning that, comparatively, the structure height above the water would be greater and fewer columns would be needed to support the roadway through the Arboretum. The very low profile of Option K would require the most columns, and the structure height above water through the Arboretum in places would be approximately 5 feet. For many visitors exploring the area by canoe, this could create a permanent perceived barrier and reduce the appeal to explore areas south of the roadway in the Arboretum.

What would the cumulative effect on recreation in the SR 520 corridor likely be?

The direct effect of converting 5 to 7.6 acres of parkland adjacent to the SR 520 corridor to transportation right-of-way—considered in the context of other past, present, and reasonably foreseeable future actions—would contribute a small physical change to the long-term cumulative effect of development on Seattle's recreational lands. Unlike the experience of past years, however, today's transportation improvement projects include mitigation in the form of replacement parkland. No permanent loss in total park area would result from the proposed 6-Lane Alternative in combination with the Medina to SR 202 project, Sound Transit's North Link and East Link light rail projects, and other planned transportation improvement and land development or redevelopment projects. In all cases, adverse effects on recreational lands would be mitigated as consistent with applicable requirements.

The conversion of parks to other uses is rare, and when conversion is necessary, there is typically a replacement of the land and function. As a consequence, state and local jurisdictions are actively increasing the amount of parks and open space within the central Puget Sound region. Cumulatively, there is likely to be a net gain over time in the total area of park land in the study area.

How could the cumulative effect on recreation be mitigated?

Parklands along the corridor are protected under Section 4(f) of the U.S. Department of Transportation Act and/or Section 6(f) of the Land and Water Conservation Fund Act and the Aquatic Lands Enhancement Account (ALEA) grant program. In part, Section 4(f) requires "all possible

planning" to minimize harm to affected properties. Section 6(f) stipulates that replacement property be provided, with agreement by agencies with jurisdiction. The Draft Section 4(f)/6(f) Evaluation (Attachment 6) provides a detailed description and evaluation of specific properties that these regulations cover.

Parklands in Seattle are further protected under Ordinance 118477, which specifies that all lands and facilities held now or in the future by the City of Seattle for parks and recreational purposes must be preserved or mitigated by providing replacement "land or a facility of equivalent or better size, value, location and usefulness in the vicinity, serving the same community and the same park purposes." In compliance with the regulatory requirements discussed above, WSDOT and FHWA are working with the City of Seattle, the University of Washington, the State's Recreation and Conservation Office, and the National Park Service to identify appropriate mitigation measures to ensure that no long-term adverse effect on parkland and recreational resources would result from construction of the proposed project.

Visual Quality and Aesthetics

What indirect effects would the project likely have on visual quality and aesthetics?

The proposed project would not produce indirect effects on visual quality and aesthetics because all changes to structures, landforms, and vegetation would be confined to direct impacts within the project area along the SR 520 corridor.

What would the cumulative effect on visual quality and aesthetics likely be?

The long-term presence of the proposed new Evergreen Point Bridge would not make much difference to the cumulative effect of past, present, and reasonably foreseeable future actions on visual quality and aesthetics because it would replace a similar bridge that exists in approximately the same location today. On the other hand, the wider roadway, retaining walls, noise walls, and other structural features introduced by the 6-Lane Alternative would create a more urban visual character. The more urban visual character would add to the cumulative effect of other present and planned development projects contributing to the increasingly urban visual quality of the study area.

Because of the region's steady population growth, traffic volumes have increased and the regional transportation infrastructure has expanded to accommodate the increasing traffic. During the 1960s, construction of the SR 520, I-5, and I-90 bridges and state and interstate highways opened more distant, sparsely developed areas to development. Today, the SR 520

corridor crosses Lake Washington to connect downtown Seattle with major Eastside urban centers such as Bellevue and Redmond, as well as smaller suburban communities. This transportation infrastructure expansion has brought a more urban visual character to the project setting. A new interchange at Montlake Boulevard under Option A, K, or L would change the appearance of that immediate area enough to contribute to the cumulative effect of an increasingly urban visual character.

As discussed in the Visual Quality and Aesthetics section of this SDEIS, the proposed project's direct effects on visual quality would be a mixture of beneficial and detrimental changes. For example, an increase in paved surfaces and concrete structures could be considered detrimental, whereas the introduction of vegetated roadway lids would add visual continuity and soften the harder effect of the solid surfaces. On balance, the cumulative effect on visual quality and aesthetics within the SR 520 study area and surrounding central Puget Sound region would be an increasingly urban visual character, to which the proposed project would make a small contribution with both beneficial and detrimental visual elements.

How could the cumulative effect on visual quality and aesthetics be mitigated?

In general, an adverse cumulative effect on visual quality and aesthetics can be minimized by community planning efforts that establish context-sensitive architectural and design standards, preserve visually significant stands of vegetation, and preserve important views and community-gathering places. In the central Puget Sound region, comprehensive planning by the Puget Sound Regional Council, which is composed of jurisdictions at many different levels, takes visual quality into account as a shared community value contributing to the quality of life throughout the region (PSRC 2008, PSRC 2009a). Continuing efforts to enhance visual quality through regional and community planning and in the design of individual development projects will help to mitigate the cumulative visual effect of increasing urbanization.

Cultural Resources

What indirect effects would the project likely have on cultural resources?

WSDOT did not identify any indirect effects on cultural resources likely to result from the SR 520 project. This is because all project-related effects on cultural resources would be within or close to the project construction footprint and occur at the time of project construction.

What would the cumulative effect on cultural resources likely be?

The proposed project would make a minor contribution to the cumulative effect on cultural resources of the central Puget Sound region. Past and present development has removed or altered the character of many cultural resources in the central Puget Sound region during the past 150 years. By the mid-twentieth century, it had become apparent that piecemeal losses of individual cultural resource sites were accumulating to a significant level.

In the project area, residential neighborhoods established in the late nineteenth and early twentieth century now include houses and other structures eligible for inclusion on the National Register of Historic Places, as explained in the Cultural Resources section of Chapter 5. Construction of the SR 520, I-5, and I-90 bridges and state and interstate highways through the area has removed some of these historic properties and also affected Native American archaeological sites. Although the project would not affect any known archaeological site or traditional cultural property, it would remove some above-ground historic properties.

Two properties that could be removed by the project are contributing elements to the Montlake Historic District. Others are individually eligible bridge structures. It is not expected that there would be sufficient loss of property from this or other reasonably foreseeable future projects to reduce the significance of any historic district enough to affect its status for NRHP eligibility. The project is not likely to add to the cumulative effect on built environment properties, archaeological resources, traditional cultural properties, or the presumed Foster Island TCP.

How could the cumulative effect on cultural resources be mitigated?

The primary federal law regulating effects on cultural resources is Section 106 of the National Historic Preservation Act. Section 106 protects resources that are listed on, or eligible for listing on, the NRHP. Under Section 106, federally sponsored or funded projects are required to avoid, minimize, or mitigate adverse effects if project activities would directly or indirectly cause harmful effects to recognized historic properties or sites.

In Washington, the Department of Archaeological and Historic Preservation, King County, and the City of Seattle also require consideration of effects to properties that have local or statewide significance, are listed or eligible for listing on the Washington Historic Register, or are designated as a King County or Seattle landmark. These agencies work together to guide and coordinate the administration of historic preservation laws and regulations in order to protect cultural resources.

Noise

What indirect effects would the project likely have on noise?

WSDOT considered all noise-related effects of project construction and operation to be direct. This is because project-related noise would be detected by people only while they were in or close to the SR 520 corridor and at the same time the noise was being generated.

What would the cumulative effect on noise likely be?

When the Roanoke Park, Montlake, and other neighborhoods west of Lake Washington in the vicinity of the SR 520 corridor were settled and developed during the opening decades of the twentieth century, they were quieter in comparison to present conditions. After World War II, population growth in the central Puget Sound region accelerated, leading to increased commercial development and roadway traffic.

In the 1960s, I-5 and SR-520 were built, and traffic noise from these major highways and from arterial roads such as East Roanoke Street, 10th Avenue East, Lake Washington Boulevard, and Montlake Boulevard NE had increased ambient noise levels substantially in comparison to the prewar years. Noise from local streets, air traffic, water-related traffic, and industry has also increased and contributed to this trend. As the number of daily trips has increased on SR 520, so has the road noise. In addition, in-filling has occurred with more residences closer to the highway than when it was built. In part because SR 520 was not constructed with today's sound dampening features, such as noise walls, the noise level is higher than on similar roadways in other parts of the state.

The 6-Lane Alternative would have noise contributions equal to or slightly less than current levels and projected future levels without the project. No reasonably foreseeable future project has been identified that would be built close enough to SR 520 to contribute to a cumulative noise effect. The project would, however, contribute to the noise effects of the other previously built transportation projects as these projects continue to operate in the reasonably foreseeable future. Each of the 6-Lane Alternative design options, compared with the 2030 No Build Alternative, would substantially decrease the number of nearby residences exceeding the NAC noise levels.

How could the cumulative effect on noise be mitigated?

The cumulative effect of transportation-related noise is gradually being mitigated as many new transportation improvement projects incorporate modern noise attenuation features, such as lids and noise walls, that were not present in the facility being replaced. As motor vehicles become more efficient and incorporate new ways to generate power, such as electric or

hydrogen propulsion, the proportion of quieter vehicles will increase over time. In addition, the Transportation 2040 Draft EIS (PSRC 2009a) notes that policies encouraging vehicle trip reductions through transit improvements, HOV lanes, and non-motorized modes of travel where practicable would further reduce the cumulative noise effect. More broadly, Vision 2040 (PSRC 2008) includes many policies that emphasize concentrating growth in urban centers within the central Puget Sound region and connecting those centers with an efficient, transit-oriented, multimodal transportation system.

Air Quality

What indirect effects would the project likely have on air quality?

The project would produce indirect effects on air quality primarily from trucks hauling construction materials to and from the SR 520 corridor and from particulate release as a result of excavation of fill materials at borrow sites distant from the construction zone. There is also a potential for tolling on SR 520 to result in higher traffic volumes on alternative routes, particularly I-405, I-90, and SR-522, thereby producing indirect effects on air quality. Compared with present conditions and likely future conditions under the No Build Alternative, these indirect effects would result from a larger number of vehicles releasing exhaust emissions along the alternative routes and from increased vehicle idling times due to increased congestion on those routes.

What would the cumulative effect on air quality likely be?

Because the Build Alternative would be a major transportation project located in a maintenance area for CO, it would be subject to transportation conformity requirements. The intent of transportation conformity is to ensure that new projects, programs, and plans do not impede an area from meeting and maintaining air quality standards. Conformity with the State Implementation Plan (SIP) means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

The project is not expected to create any new violations, nor increase the frequency of an existing violation of the CO standard; it would conform with the purpose of the current SIP and the requirements of the federal Clean Air Act and the Washington Clean Air Act. As a "regionally significant" project, the proposed project is included in the current regional transportation plan (RTP), Destination 2030 (PSRC 2007), and in Central Puget Sound Regional 2007-2010 Transportation Improvement Program (TIP), which lists all current transportation projects (PSRC 2009b). The RTP and the TIP meet the conformity requirements identified by federal

and state regulations for CO. The proposed project is also included in all of the action alternatives in the Transportation 2040 Draft EIS (PSRC 2009a).

How could the cumulative effect on air quality be mitigated?

Cumulative effects on air quality are being minimized by continuing advancements in automobile technology, fuel content regulations, and the increased availability of alternative fuels. Major efforts are underway to reduce vehicle miles traveled and to improve the overall efficiency of the transportation system. Washington's Commute Trip Reduction Program continues to be the primary transportation demand management strategy in the central Puget Sound region. The program targets commutes in high-traffic areas, including strategies such as employee parking management and incentives for commuting by means other than driving alone (PSRC 2009b).

Energy Consumption and Greenhouse Gas Emissions

What indirect effects would the project likely have on energy consumption and greenhouse gas emissions?

Indirect effects related to energy consumption would occur if construction and operation of the project were to cause measurable effects on other sectors of the economy, such as utilities, or affect the ability of Washington State to meet the energy demands for this project, requiring expansion of existing resources. There is no indication that this would be the case, in part because Washington State relies heavily on hydropower to generate electricity. The project's operational contribution of about 1 percent of the state's total annual transportation energy consumption, previously noted, would be too small to have a consequential indirect effect.

Approximately 90 percent of Washington's current supply of crude oil comes from the Alaska North Slope. Five refineries in the Puget Sound area distribute refined petroleum products to Washington and adjacent states (CRC Draft EIS, 2008). Energy supplies are sufficient to build and operate the project without placing undue demands on energy sources and would not affect other sectors of the economy.

In general, operation of the project would improve energy consumption and GHG emissions over the No Build Alternative. The addition of HOV lanes as part of the corridor system and a regional bike path would be consistent with the Governor's Executive Order 09-05, which includes direction to WSDOT to continue developing GHG reduction strategies for the transportation sector.

No negative GHG-related effects would result from the project relative to expected conditions under the No Build Alternative. With or without the project, cumulative GHG emissions from vehicles using SR 520 would

increase by 2030, but the increase would be slightly less under the proposed 6-Lane Alternative than with the No Build Alternative.

What would the cumulative effect on energy consumption and greenhouse gas emissions likely be?

With any of the design options, construction and operation of the proposed 6-Lane Alternative, along with the other present and reasonably foreseeable future transportation improvement projects shown in Exhibits 7-5a and 7-5b would make a very small contribution to statewide GHG emissions. At the same time, the 6-Lane Alternative's long-term operation would reduce VMT below present conditions and below future conditions projected for the No Build Alternative.

Operation of the SR 520, I-5 to Medina project in conjunction with the SR 520, Medina to SR 202: Eastside Transit and HOV Project, the East Link and North Link light rail projects, and other reasonably foreseeable future transportation improvement projects shown in Exhibits 7-5a and 7-5b would consume energy and emit GHGs over the long term. However, these projects would together generate a smaller contribution to the cumulative effect on energy consumption and GHG emissions than their No Build Alternatives because the projects would reduce VMT and improve regional transportation efficiency.

HOV lanes would encourage people to carpool, vanpool, or take transit, assisting in reducing GHG emissions. Tolling of the corridor is also anticipated to encourage transit use and reduce VMT on the corridor. Over the long-term, improvements proposed for the SR 520 corridor in conjunction with Sound Transit's light rail projects would contribute to meeting GHG reduction goals outlined by the legislature and the Governor.

How could cumulative effects on energy consumption and greenhouse gas emissions be mitigated?

Energy consumption produces GHG emissions, which are known to contribute to global climate change. Global climate change is being addressed at local, regional, national, and international levels.

As discussed above, state policies are in place to reduce GHG levels substantially between now and 2050. Examples of strategies being implemented to reduce GHG levels include providing alternatives to driving alone (such as carpooling, vanpooling, and transit); developing transportation facilities that encourage transit, HOV, bike, and pedestrian modes; supporting land use planning and development that encourage such travel modes (such as concentrating growth within urban growth areas); and optimizing system efficiency through variable speeds and tolling.

The cumulative effect on GHG emissions would be further reduced by continuing advancements in automobile technology, fuel content

regulations, and the increased availability of lower-carbon fuels. Furthermore, the region's dedication to providing alternative transportation options, such as public transit and bicycle trail networks, could help reduce the number of single-occupancy vehicles on the roads (PSRC 2009a).

Water Resources

What indirect effects would the project likely have on water resources?

As documented in the Water Resources section of Chapter 5, the 6-Lane Alternative would not have an adverse direct or indirect effect on water resources because stormwater runoff and waterborne contaminants would be mitigated. During project construction, WSDOT would prepare and follow a Temporary Erosion and Sediment Control Plan and collect and treat stormwater runoff from the project footprint in compliance with National Pollutant Discharge Elimination System (NPDES) requirements and WSDOT BMPs. Consequently, stormwater discharged during construction activities would not cause a change from the baseline condition of receiving waters or violate Washington State Water Quality Standards.

WSDOT expects that the project would not violate state Water Quality Standards during its long-term operation. The improved highway infrastructure, including improved stormwater treatment facilities, would reduce pollutant amounts in stormwater runoff relative to the paved surfaces that exist on SR 520 now. The improved stormwater treatment associated with the project could have slight direct or indirect beneficial effects on water quality. There would be no adverse indirect effects associated with the operation of stormwater quality treatment facilities as part of the project action.

What would the cumulative effect on water resources likely be?

The SR 520 roadway surface and many other older roadway surfaces in the project area currently release untreated stormwater runoff into surface waters, including Lake Washington. This runoff contains contaminants from vehicle engine leaks, exhaust fumes, tire residue, and other sources.

As new transportation improvement projects are built, they introduce stormwater treatment facilities that reduce amounts of contaminants entering surface waters to levels that meet state and federal standards. The long-term trend, therefore, is a gradual improvement in surface water quality as stormwater runoff receives increasing treatment. The proposed 6-Lane Alternative, along with the Medina to SR 202: Eastside Transit and HOV Project, the East Link and North Link light rail projects, and other reasonably foreseeable future transportation improvement projects shown

in Exhibits 7-5a and 7-5b would contribute to the positive trend of improved surface water quality.

Stormwater runoff during construction of the proposed 6-Lane Alternative would be mitigated in accordance with NPDES requirements and WSDOT BMPs to minimize the entry of waterborne contaminants into surface waters. During the project's long-term operation, the improved stormwater treatment facilities provided by the project would reduce pollutant runoff from SR 520 paved surfaces relative to present conditions and the No Build Alternative. For these reasons WSDOT concluded that the proposed project would slightly offset negative trends from other past and present projects, and slightly add to the gradual improvement of water quality expected in the study area between now and 2030.

How could the cumulative effect on water resources be mitigated?

The cumulative effect of land development and transportation improvement projects on water quality could be minimized by continuing application of stormwater treatment technologies as projects are built and operated. To address existing sources of untreated runoff, regional water quality investments may be needed. These could include systematic retrofitting of local streets and parking lots.

Ecosystems

Ecosystems can be divided into three components: wetlands, fish and aquatic habitat, and wildlife. The project would directly affect wetlands, streams, and wildlife habitat, but these effects would be mitigated as part of the project. Mitigation details are presented in the Ecosystems section of Chapter 5 and the Ecosystems Discipline Report (Attachment 7).

Wetlands

What indirect effects would the project likely have on wetlands?

The wetlands assessment did not identify any expected indirect effects of the proposed project on wetlands. For a discussion of expected direct effects on wetlands, see the Wetlands section of Chapter 5 and the Ecosystems Discipline Report.

What would the cumulative effect on wetlands likely be?

As discussed in the Ecosystems Discipline Report, WSDOT worked to avoid and minimize impacts to ecosystems during the scoping and design of this project. WSDOT avoided many impacts to wetlands through careful identification of sensitive areas early in the design process.

Where avoidance was not possible, effects were minimized by raising bridge heights to reduce shading and limiting the construction areas. By providing

stormwater treatment, the project would improve water quality functions of wetlands, thereby making a beneficial contribution to wetland resources. Through BMPs, conservation measures, and the application of specific construction sequencing and timing (such as minimizing in-water work), WSDOT would ensure that short-term construction effects on wetlands would be small and not lead to decreased wetland function. Where adverse effects could not be avoided or minimized, WSDOT would identify compensatory mitigation to reduce the cumulative effect of the project on wetlands. The proposed mitigation would be developed in coordination with regulatory and resource agencies.

Other reasonably foreseeable land development and transportation improvement projects that could affect wetlands include projects in the University of Washington Campus Master Plan, the Bel-Red Corridor Project, the Medina to SR 202: Eastside Transit and HOV Project, the SR 167 road improvement projects, the SR 18 Tiger Mountain Road improvements, the SR 522 Snohomish River Bridge to US 2 improvements, and other projects shown in Exhibits 7-4a through 7-4d and 7-5a and 7-5b. These projects would be required to follow federal, state, and local wetland regulations, including mitigation of project effects. Because of these mitigation requirements, the cumulative effect of these other reasonably foreseeable projects, along with the proposed 6-Lane Alternative, would be neutral and would not add to the adverse cumulative effect of past development on wetlands.

How could the cumulative effect on wetlands be mitigated?

The federal wetland regulatory goal of No Net Loss and recently updated state and local regulations for protecting and managing critical areas under the Growth Management Act are intended to slow the cumulative decline of wetlands. Beyond these measures, the cumulative effect of wetland conversion and loss could be mitigated by more stringent regulations, greater regulatory consistency and coordination among jurisdictions, improved planning at both regional and local levels, and increased participation of non-governmental organizations and other stakeholders in restoration efforts. Long-term programs such as watershed-based mitigation and mitigation banking also aid in the protection of the resource. For example, Ecology has prepared two guidance documents to facilitate more effective compensatory wetland mitigation. These are *Wetland Mitigation in Washington State, Part 1: Agency Policies and Guidance* (Ecology et al. 2006a), and *Wetland Mitigation in Washington State, Part 2: Developing Mitigation Plans* (Ecology et al. 2006b), both prepared as part of a collaborative effort among Ecology, the U.S. Army Corps of Engineers, and the EPA. The City of Seattle has comprehensive plans and critical areas ordinances that guide future community development so that adverse cumulative effects on wetlands can be alleviated.

Aquatic Resources

What indirect effects would the project likely have on fish and aquatic habitat?

Because of the project location, project effects on habitat would generally be limited to the lake and estuarine environments in the study area, not farther removed in distance, and would be consistent with those occurring from existing uses and activities. In addition, WSDOT did not identify any potential effect of the project on fish and aquatic habitat that would occur later in time than the project activity causing the effect. Therefore, the 6-Lane Alternative is not expected to result in measurable indirect effects on fish and aquatic habitat.

What would the cumulative effect on fish and aquatic resources likely be?

WSDOT determined that many of the reasonably foreseeable future actions shown in Exhibits 7-4a-d and 7-5a-b could affect aquatic resources, particularly projects that include stream crossings. The Pontoon Construction Project and the Medina to SR 202 project, both transportation-related, were included in the analysis as either present or reasonably foreseeable future actions because they could be completed or in progress while the SR 520, I-5 to Medina project is being built.

Present and reasonably foreseeable future actions such as these and the SR 99 - Alaskan Way Viaduct and Seawall Replacement Project, the SR 167 road improvements, and others could contribute to the continued decline of fish stocks in WRIAs 8 and 22 by: 1) continued alteration of ecosystem processes, 2) changes in flow regimes, and 3) increased impervious surface area leading to increased water pollutant loading to area waterways. However, compared to the number and magnitude of existing stressors within the study area, WSDOT determined that effects from the reasonably foreseeable future actions, including the project's contribution, to existing fisheries trends or stressors, would be relatively minor because:

- The study area is so large, with ecosystem-wide stressors (decreased water quality and water temperature/ocean current alterations due to global climate change)
- Individual fish from these watersheds might be negatively affected, not only within the watersheds, but in the Pacific Ocean, up to 2,000 miles from the study area

The project would contribute to cumulative effects on fish and aquatic habitat in a number of ways. The increase in overwater structures related to the west approach and the Montlake area could change juvenile salmon migration movements through the study area and potentially provide additional habitat for predator species. Such changes could continue to affect future generations of juvenile salmonids rearing or migrating through the project area. On the basis of a recent fish tracking study in the west

approach and Montlake areas, these effects are expected to be minor (Celedonia et al. 2008).

The long-term effects of the larger replacement bridge on aquatic habitat could result in somewhat greater effects on migration routes through the study area compared to the existing bridge. It is possible that the increased height of the replacement bridge, near the west highrise, could offset some of the potential shading effects of the wider structure. The west highrise area is a primary migration corridor for juvenile salmonids passing through the study area (Celedonia et al. 2008).

Including the expected mitigation developed to address potential project impacts, the improvements over present conditions resulting from the project could offset the temporary adverse construction effects, and the improvements over present conditions would extend farther into the future. For example, the treatment of stormwater runoff from the bridge and upland road surfaces in the study area would be a long-term improvement relative to existing conditions in which no stormwater treatment is provided. Other long-term improvements over present conditions would include the increased height of the overwater structures in many areas and the reduced number of in-water columns.

Because of the expected improvements in water quality resulting from the treatment of stormwater and the changes in in-water structures, the contribution of the SR 520, I-5 to Medina project to the cumulative effect on long-term fisheries trends and stressors would be negligible. This is true for the same reasons discussed previously for other reasonably foreseeable future actions.

Based on the estimated fish populations within the study area, the SR 520, I-5 to Medina project actions are expected to affect only a portion of all of the fish occurring in the watersheds. Furthermore, the amount of habitat within the study area represents only an extremely small fraction of the habitat available within the area watersheds, and only a small portion of that fraction is regularly used by anadromous species (primarily the nearshore and shallow water habitat areas). Considering the expansive marine habitat used by these species, the habitat in the study area represents only a small fraction of the total fish habitat used by these fish during their life cycles. In summary, the SR 520, I-5 to Medina project's contribution to the overall condition of fish and aquatic resources within the study area would not measurably influence the overall cumulative effect on these resources.

How could the cumulative effect on fish and aquatic resources be mitigated?

A variety of measures could mitigate the cumulative effects on fish and aquatic resources. For example, a region-wide cooperative interagency approach or public-private partnerships, with a focus on improving fish

habitat conditions and water quality within the Lake Washington watershed and Puget Sound, would aid in the recovery of fish stocks. More stringent land use regulations could reduce future negative effects on fish associated with stormwater runoff and human development.

Wildlife and Wildlife Habitat

What indirect effects would the project likely have on wildlife and wildlife habitat?

The wildlife species and habitat types potentially affected by the alternatives are identified and described in Chapter 4 and in greater detail in the Ecosystems Discipline Report. All of the design options could affect wildlife by permanently removing or shading vegetation and other features of wildlife habitat, but also by improving stormwater treatment, and decreasing noise disturbance. Direct effects on wildlife would vary by species and throughout the project corridor. They could occur, for example, if animals move to other areas in response to habitat loss, displacing or competing with individuals already present in those areas.

What would the cumulative effect on wildlife and wildlife habitat likely be?

In general, wildlife within in the study area has been affected and will continue to be affected by past actions, present actions, and reasonably foreseeable future actions. The availability of suitable habitat for many species of wildlife would likely continue to decline. In contrast, wildlife adapted to urban conditions (such as crows, sparrows, and raccoons) would likely continue to flourish.

WSDOT has made efforts to avoid and minimize negative effects on wildlife. Under all 6-Lane Alternative options, however, there would be a permanent loss of habitats used by urban-adapted wildlife such as those noted above. Adverse effects associated with habitat loss could be partially offset by long-term improvements in stormwater quality, decreased noise disturbance, and reduced barriers to animal movement. The project would remove a small amount of forested habitat on Foster Island that could be used by species of concern such as Great Blue Heron and Wood Duck, producing a minor adverse contribution to the cumulative loss of habitat for such species. The project's long-term contribution to urban-adapted wildlife populations and habitats in the study area would be negligible.

How could the cumulative effect on wildlife and wildlife habitat be mitigated?

Because there are many potential contributors to cumulative effects outside of WSDOT's jurisdiction, the agency will not attempt to mitigate adverse cumulative effects. However, a variety of measures could mitigate the overall (non-project-related) cumulative effects on wildlife, such as the following:

- More stringent regulations.
- Improved planning on a larger scale.
- Better coordination among agencies.
- National or global agreements limiting the emission of GHGs that could help slow or stop global climate change.
- Voluntary efforts by individual developers, at relatively small additional cost. These efforts could create small but, with time, cumulatively substantial new habitat areas to slow and offset cumulative habitat loss from past development. Such measures could include:
  - Using native plants in landscaping
  - Designing curved or irregular rather than straight boundaries between vegetated and non-vegetated areas
  - Leaving islands of native vegetation connected by vegetated corridors
  - Providing vegetated buffers along streams

Geology and Soils

What indirect effects would the project likely have on geology and soils?

The only potential indirect effect associated with the project would relate to mineral material extraction and use. Aggregate for concrete and other granular material for construction fill would be mined from borrow pits distant from the project site, reducing by a small amount the regional availability of aggregate and fill for use on other projects. Because material extraction would occur farther in distance from the SR 520 corridor than other construction effects, this is considered to be an indirect effect of the project. WSDOT considers this indirect effect to be minor because the volume of aggregate used by the project would be small in comparison with the regional supply.

What would the cumulative effect on geology and soils likely be?

The SR 520 project would be constructed to current seismic standards and decrease the risks associated with a seismic event along a major transportation corridor used by thousands of people every day. Construction of the project would contribute toward depleting regional sources of aggregate in conjunction with other past, present, and reasonable and foreseeable projects in the central Puget Sound region. However, given the large supply of aggregate across the region, no adverse cumulative effect is expected.

How could the cumulative effect on geology and soils be mitigated?

The incremental reduction of aggregate supply cannot be avoided, but reuse of demolition debris and excavated soils could mitigate this cumulative effect. County and local governments, and the state Department of Natural Resources, regulate extraction and mining in Washington state and require reclamation plans to restore gravel pits to a vegetated condition after use.

Hazardous Materials

Hazardous materials are not themselves a resource that would be evaluated for cumulative effects. Hazardous materials can, however, enter the air and water and eventually affect human health and ecosystems. Hazardous materials can be associated with contaminated soils and groundwater, building materials encountered through demolition, accidental spills at construction sites, and leaking underground storage tanks. Depending on the type of contamination, there can be risks to worker safety and public health as well as environmental damage.

The risk of encountering hazardous materials during the construction of this project is low, however, and safeguards would be in place to minimize temporary impacts, including the WSDOT Spill Prevention Control and Countermeasures Plan for construction projects. The 6-Lane Build Alternative would further contribute to the gradual reduction in existing ground and water contamination by removing hazardous materials that might be encountered during construction. See the Hazardous Materials section on Chapter 5 and the Hazardous Materials Discipline Report (Attachment 7) for additional information on hazardous materials effects that could be associated with the project and how WSDOT would mitigate them.

Transportation improvement projects improve hazardous material conditions because contaminated soil or water encountered during construction must be removed and disposed of, leaving the site cleaner than it was before. The Transportation 2040 Draft EIS (PSRC 2009a) concludes that future projects will continue a positive, declining trend in the total amount of hazardous materials present in the central Puget Sound region.

Navigation

What indirect effects would the project likely have on navigation?

While Options A and L of the 6-Lane Alternative would add a new bascule bridge over the Montlake Cut, operational effects on navigation, whether direct or indirect, would be minimal because of the similarity to the design parameters of the existing Montlake Bridge and the coordination of bridge

openings of the existing and proposed bridges. Vessels moving either east or west would signal the first of the two bridges they encounter, which would cause the opening of both bridges to allow passage. Operation of the Option K tunnel would not affect navigational needs in this part of the study area.

On Lake Washington, one result of replacing the existing Evergreen Point Bridge would be the permanent elimination of the draw span and the establishment of a height restriction on vessels passing under the new bridge. However, it is likely that establishing a vessel height restriction would have no discernible effect on navigation, including indirect effects such as schedule delays or changes in cruise plans. This conclusion is based on the ability of vessels currently using the draw span to use the future east navigational channel and on the absence of any major development plans by Seattle, Bellevue, or Renton along the shorelines south of the Evergreen Point Bridge. Because the design of the 6-Lane Alternative adequately provides for the navigational needs of the commercial and recreational boating communities, WSDOT does not anticipate indirect effects of project operation on navigation.

What would the cumulative effect on navigation likely be?

The closure of the mid-span drawbridge would impose a vertical height limitation on vessel traffic moving south of the floating portion of the Evergreen Point Bridge, and impose an additional clearance limit on Lake Washington overall. Because the clearance limit would essentially match that of the I-90 lake crossing, and because there would be minimal effects to vessels that use the lake, WSDOT has not identified any potential project contribution to a cumulative effect on navigation.

How could cumulative effects on navigation be mitigated?

The U.S. Coast Guard approves the locations and clearances of bridges crossing navigable waterways by issuing a bridge permit under the authority of the General Bridge Act of 1946 and Section 9 of the Rivers and Harbors Act of 1899. Agreements between FHWA and the U.S. Coast Guard are in place to ensure that the potential effects of transportation infrastructure and bridge projects on navigable waterways are evaluated and appropriate mitigation identified.